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ENGINEERING NEWS.

GREAT BRITAIN'S MOST SERIOUS RAILWAY ACCIDENT for many years occurred near Armagh, Ireland, on June 12. A special excursion train was to be run from Armagh to a watering place at the mouth of the Newry river, in County Down, to carry the Sunday-school scholars of Armagh. The train was run in two sections; and while the second section was ascending a steep grade, some of the rear cars broke away from the train and started back down the grade. Before they reached the bottom, and while running at a high speed, they collided with the regular train which was following. The total deaths from the accident thus far reported are 74, and a great number of persons sustained serious injuries. The fatality was confined to the passengers on the runaway cars. No one on the other train was injured.

ANOTHER ACCOUNT of the accident, which seems much less probable, is to the effect that the engineer of the second section found that he could not pull the whole train to the top of the grade, and therefore detached the last few cars, and blocked the wheels with pebbles, to prevent their starting down the grade, while he went with the forward cars of the train to the next station. But, when the locomotive started, the pebbles were displaced, and the cars at once started down the grade.

When the passengers in the runaway cars found their plight they tried to escape from the cars, but the doors of course were locked. Many, however, managed to crawl through the windows and escape uninjured. The lessons which the disaster should teach seem plain enough, on this side of the water at least, but our space will not permit us to comment upon them in this issue.

THE LOSS OF LIFE AT JOHNSTOWN is fortunately proving less than we feared last week. It now seems likely to have been about 6,000, with limits of error of about 1,000 either way; but on the whole, with more likelihood of proving less than more than 6,000. It is easy to see how the error arose. While the destruction in the bottom of the valley was very complete, there were hundreds of houses on the slopes which were not injured at all. These immediately opened their doors to the homeless, and many of them were and are yet crowded by refugees, accounting for the comparatively small number of homeless ones seen wandering about. The press despatches from Johnstown have naturally had most to say about the houses destroyed and not the houses saved, which were much more numerous than could be inferred from the reports. In all other respects the despatches have not and could not exaggerate the completeness of the ruin. Had the disaster occurred in the night, the destruction of life probably would have closely approached 20,000. As it is, some now estimate the loss as under rather than over 5,000, but this, we are satisfied, is too great a reaction. Some 3,500 bodies (the exact figures are not reported) have now been actually recovered; hundreds were burned up in the flames at the great jam; hundreds of more or less mutilated bodies still remain in it, and in our opinion scores if not hundreds of bodies were actually ground into fragments, as were the bricks and stones with which they were intermingled.

THE FURY OF THE TORRENT at Johnstown was something quite beyond the range of prior experience, because in no other occurrence of the kind has such an enormous volume of water been suddenly released at the head of a narrow valley 14 miles long, with so great a fall, about 378 ft. from top of dam to top of the stone bridge at Johnstown. The most vivid evidence of this fact is the fate of the locomotives in the Conemaugh round-house, 3 miles above Johnstown bridge. There was not one of 16 or more locomotives at that point which was not carried off 100 to 200 ft.; there are about a dozen scattered about in all directions over the torrent-bed where once was Conemaugh, at distances of 400 to 1,200 ft. from the former site of the round-house (which is gone, foundations and all), all of them nearly and some of them completely buried in rocks and sand. These locomotives were all or nearly all of the heaviest types of Consolidation, being used for mountain helpers; and two of those which were carried farthest lie close together, one having stopped the other. The tenders were mostly carried a mile or more down stream, many of them only stopping at the Johnstown stone bridge, while it is reported that some locomotives are in the jam at that point which were carried by the torrent clear from Conemaugh. We do not know that this is so, but no one who has seen the wreckage will question that it may easily have been the case. As one evidence of this, Mr. MCHENRY, one of the higher officials of the Cambria Iron Co., who was standing in the thirdstory of the brick club house, which escaped complete destruction by the flood, testifies that he saw from the window a locomotive go by which appeared for the instant to be floating like cork on the top of the water, 30 ft. above the ground! We satisfied ourselves by personal inquiry that this incident actually occurrrd.

A COMMITTEE TO INVESTIGATE the Johnstown disaster, consisting of Messrs. J. MAX. BECKER, President, JAS. B. FRANCIS and WM. E. WORTHEN, ex-Presidents, and A. FTELEY, Chief Engineer of the new Croton Aqueduct, has been appointed by the American Society of Civil Engineers, and will proceed to the scene of the disaster as soon as railway communication is re-opened. They will no doubt cause a thorough and exact instrumental survey to be made, investigate the structure of the dam critically, by excavations and otherwise, and thus usefully supplement the necessarily hasty investigations made immediately after the disaster. It is eminently proper that such a committee should be appointed and a better committee could not be appointed, although Mr. WM. J. MCALPINE would have been a very desirable fifth member, if he would have consented to serve. Probably no man, in this country, living or dead, has had a larger experience in the construction of dams of this class.

THE POTOMAC FLAT IMPROVEMENTS, at Washington, D. C., said to be ruined by the late flood, are not so badly damaged as at first reported. Col. HAINS says the greatest damage sustained is in filling up both channels. The Virginia channel is reduced in depth from 20 to 13 ft. The banks of the canal ar intact.

CIVIL ENGINEERS VS. CIVIL SERVICE is just now interesting the Geological Survey. This bureau is forganizing several parties for work in the irrigation survey of the West. While the chiefs of the survey have been appointed by the bureau, the Civil Service Commission demands the right to designate all the subordinates. This is nonsense. The chief, who is responsible for the work performed, should also have the untrammelled selection of his agents. This is not a case where one man is as good as another as far as the public service is concerned.

THE AMERICAN ENGINEERS, civil and mechanical, have reached Liverpool and were there received by a local reception committee, and a deputation of members of the Institution of Engineers, the Liverpool Engineering Society, and other technical bodies. Visits have been made to the Estates of the Mersey Dock and Harbor Board, the Birkenhead Iron Works and Mersey tunnel. In the evening an official reception was given by the Mayor in the Town Hall. Most of the engineers next visited the Manchester Ship Canal.

THE NEW CHANNEL STEAMER *Calais-Douvres* in her trial trip on the Clyde on May 27, steamed 22¾ knots per hour. This vessel went into service between Dover and Calais on June 1. She has a double bow, has rudders at both ends, and is 325 ft. long, 36 ft. beam, and 21 ft. deep. Her engines are of the compound diagonal type and develop 6,000 H. P. The steamer has accommodations for 900 passengers.

A NEW SCHEME FOR MARINE PROPULSION is being experimented with by Mr. JOHN LECOY, of Brooklyn, N. Y. His pneumatic propulsion vessel, *The Eureka*, made a trial run on the East River recently. The source of her power is a mixture of petroleum vapor and air, which is exploded by an electric spark, and acts on the water at the stern through two apertures, one in each quarter. The vessel attained no great speed, but was able to make some headway against a strong tide.

THE MOST SERIOUS RAILWAY ACCIDENT of the week was the derailment of a passenger train, June 10, on the Lehigh Valley Railroad, near Wilkesbarre, Pa. According to report, the accident was caused by the breaking of a wheel or axle on the rear truck of the tender while the train was running at about 25 miles per hour. The tender broke loose from the engine, and 3 of the cars were derailed; 2 cars and the tender went down the bank and were badly wrecked. About 16 persons were more or less injured.

THE FOLLOWING TRESTLE ACCIDENT occurred June 7. The Carthage trestle, near Carthage, Ala., on the Alabama Great Southern Railroad, was set on fire early in the morning and caused the wreck of an express passenger train. Nobody was injured, but the engine, tender, mail and baggage cars were burnt, with about 70 ft. of the trestle.

HEAVY STORMS have occurred in New York and New England following upon the recent storms that have caused so much damage. Near St Albans, Vt., 6 bridges were carried away, and other bridges in the same county were also carried away. At Oakland, Me., a culvert on the Maine Central Railroad was washed out, causing the wreck of a passenger train and the injury of 6 persons. At Holyoke, Mass., about 100 ft. of the stone wall on east side of the lower level canal was washed out, and a bridge carrying the Connecticut River Railroad over the canal was wrecked. Floods and washouts have also occurred in Indiana.

THE UNITED ORDER OF RAILWAY EMPLOYES has been organized at Chicago by a confederation of the firemen's brotherhood, and the switchmen's and brakemen's associations. The old organizations will be kept up, and the new organization simply provides for united action by the three classes of employés when necessary. The conductors and engineers are to be induced to join the new order if possible.

HIGH LEVEL RAPID TRANSIT FOR CHICAGO, on the plan of H. A. STOLTENBURG, C. E., lately noticed in this journal, is favored by ex-Mayor CARTER H. HARRISON as far as its general features are concerned; but he doubts the feasibility of running over house-tops unless the property is bought, and thinks that such a road could be better run directly

over a broad street, as its elevation would cause it to interfere very little if any with light, etc. At a considerable elevation, the trusses could be made heavier without shutting out daylight, and the safety appliances against derailing could also, for the same reason, be made more efficient than in a low-level track. In other words, the high-level road could really be made safer. Curves could be made much easier than where these are limited by house-lines. Mr. HARRISON thought the scheme a perfectly feasible one, requiring only money for its perfection.

THE LOA-ANTOFAGASTA VIADUCT is not the "highest railway viaduct in the world," as remarked in our issue of May 18. We forgot the Garabit viaduct, over the river Truyère in Southern France; this is 401 ft. high from water to rail, as compared with the 337 ft. of the South American aduct.

THE HUDSON RIVER TUNNEL has about 50 men at work. As it is reported that a considerable amount of the $2,500,000 English loan is available, more active work is promised in the immediate future.

CITY OWNERSHIP AND CONTROL OF THE WATER SUPPLY, in Syracuse, N. Y., was the popular verdict of last week in a vote of 11,302 to 910 opposed to such ownership. Commissioners are now to be named to perfect a plan of action.

THE J.R. BARTLETT WATER SYNDICATE is reported to have received a proposition from the Citizens' Committee of Jersey City concerning a better water supply. As near as can be learned, the committee offered $20 per million gallons delivered in the city pipes, reserved the city's rights in the Passaic river and the right to obtain at any future time a supply of its own. The contract was to run 25 years. As Mr. BARTLETT'S proposition of one year ago was $40 per million gallons delivered at Belleville, and as his company is supposed to buy all the present plant and assume all the water debt and pay interest on its bonds, the acceptance of the Citizens' proposition is not a foregone conclusion.

THE WILLIAMES SYSTEM OF CAR HEATING by steam from the locomotive has been experimented with for 2 years on the Pennsylvania Railroad, and the general introduction of the system is contemplated.

THE LIFE OF STEEL RAILS is fixed by a German commission at an average of 35 years. This is the result of observations extending over 6 years made on railways in Germany, Austria, Hungary, Holland, and Belgium. The conditions assumed are an annual traffic of 3,480,000 tons and a minimum and maximum wear and tear of 0.007 and 0.017 millimetres. The commission admits, however, that before reaching this maximum the rail would probably be condemned. The traffic figure adopted also represents the passage of 24 passenger and 10 freight trains per day of the light continental type.

THE PENNSYLVANIA RAILROAD by the breaking of the South Fork dam on May 31, had its roadbed entirely washed away or buried under the débris for a distance of about 3 miles in the Conemaugh valley, besides suffering heavy washouts and the loss of bridges all along the line between Altoona and Pittsburg. On June 18, the damage was all repaired so that the line was again opened from Altoona to Pittsburg. The officers and employés of the company may well be proud of the record they have made in dealing with an unprecedented disaster.

THE SOUTH FORK DAM and the body of water which it stored have been described by the daily press with more regard to rhetorical effect than to technical accuracy. One of the Associated Press dispatches, sent soon after the accident, described the lake as probably the largest reservoir of water, either natural or artificial, in existence. This statement seems to have been received with implicit confidence byone of our contemporaries, the *Railway Age* of Chicago, for in describing the dam editorially it caps the climax of absurdity by saying that this dam "formed the retaining wall for probably the largest body of artificial water in the world."

THE DENVER & RIO GRANDE'S annual report is learnedly discussed by the Denver *Republican*, which makes the following comical blunder in explaining how it was that the net earnings decreased while traffic increased:

The traffic was maintained, but rates were not. The rate per passenger per mile in 1887 was $3.09, and in 1888 it was only $2.79. The rate per ton per mile of freight in 1887 was $2.30, and in 1888 it was $2.19. This difference of 20 cts. per ton per mile on freight is enough to cut deep into the earnings of any company.

If these figures indicated the average cost of railway transportation in Colorado, the *Republican's* frequent tirades against "extortionate monopolies" would be quite excusable.

THE SHOP ENGINE AS SHE IS WORKED.—The Westinghouse Machine Co. recently sent experts equipped, with the necessary instruments, to visit a number of prominent manufacturing establishments in various parts of the country, to test the consumption of power by each machine. As a rule, permission was readily obtained from the owners, they seeming much interested in the results. The results are amusingly indicative of the carelessness shown in such matters. *Nearly* all were found to be wasting one-half of their engine's power in doing other than useful work. One prominent establishment was wasting 65 per cent. of its fuel and power; another was wasting 73 per cent., thus leaving only 27 per cent. of the engine's power to earn money with. Another celebrated firm (known all over the West) was using a 60 H. P. engine, of which 55 H. P. was being consumed in dead work: thus leaving just 5 H. P. with which to produce goods for sale:

FATAL ACCIDENTS AT THE FORTH BRIDGE, says the *Pall Mall Gazette*, amount to 53, from all causes connected with the bridge and including five persons drowned. As regards those killed in the actual construction of the bridge, there have been 44 lives lost, death taking place either at the time of the accident or soon after. The total number of accidents which had occurred up to September, 1888,—mostly in the four years beginning with September, 1884,—was 543, of which the greater part, of course, were of the description ranging from "serious" to "slight." Of these 543 cases, 84 were treated in hospital, and 459 at the homes of the injured persons. The following hairbreadth escapes are recorded: One man trusted himself to work at a height of 120 feet over the waters of the Firth, simply grasping a rope. His hands got numbed with cold his grasp relaxed, he fell backwards down, and into the water, and he was fished up alive. In another instance a spanner fell a distance of 300 ft., knocked off a man's cap, and fell on the wooden stage at his feet, and went clean through a 4-in. plank. In another case somewhat similar, a spanner which fell from a great height actually tore a man's clothes from his waistcoat to his ankle, and left him uninjured. One of the most thrilling incidents heard of was that in which the "staging," or scaffolding on which the men work high up in mid air, gave way, carrying a number of poor fellows in its fall. Two of these men, striking some portion of the work in their descent, were killed before they reached the water; one or two others, who fell clear of the girders, were rescued from the Firth little the worse for their fall and immersion; two others, however, managed as they fell to grasp at one of the struts high up above the water, and there they clung for dear life. To effect their rescue was itself an undertaking of no slight danger: but efforts were promptly made, and before long the man who happened to be nearest the rescuer was reached. And this brave fellow, hanging there to the iron work, actually persuaded the rescuers to delay taking him off before they saved his companion. "Never mind me!" he said. "I can hold on a bit longer. Go and see to my mate, for he's getting dazed, and he'll drop." We are glad to record that this hero, and his mate too, were saved.

The 1890 Census.

The Superintendent of the Census has issued the following circular to the medical profession as to enumeration of deaths for the 1890 census, showing that a very important and difficult department of the census work is being grappled with in time, so far as possible.

Department of the Interior, Census Office,
WASHINGTON, D. C., May 1, 1889.

Dr. JOHN S. BILLINGS, Surgeon U. S. Army, has consented to take charge of the Report on the Mortality and Vital Statistics of the United States as returned by the Eleventh Census. As the United States has no system of registration of vital statistics, such as is relied upon by other civilized nations for the purpose of ascertaining the actual movement of population, our census affords the only opportunity of obtaining near approximate estimate of the birth and death rates of much the larger part of the country, which is entirely unprovided with any satisfactory system of State and municipal registration.

In view of this, the Census Office, during the month of May this year, will issue to the medical profession throughout the country a "Physician's Register" for the purpose of obtaining more accurate returns of deaths than it is possible for the enumerators to make. It is earnestly hoped that physicians in every part of the country will co-operate with the Census Office in this important work. The record should be kept from June 1, 1889, to May 31, 1890. Nearly 26,000 of these registration books were filled up and returned to the office in 1880, and nearly all of them used for statistical purposes. It is hoped that double this number will be obtained for the Eleventh Census. Physicians not receiving Registers can obtain them by sending their names and addresses to the Census Office.

If all medical and surgical practitioners throughout the country will lend their aid, the mortality and vital statistics of the Eleventh Census will be more comprehensive and complete than they have ever been. Every physician should take a personal pride in having this report as full and accurate as it is possible to make it. It is hereby promised that all information obtained through this source shall be held strictly confidential.

ROBERT P. PORTER,
Superintendent of Census.

It is to be regretted, however, that it should depend on the courtesy of physicians to make such returns once in ten years, when they ought to be required by law to make them every year. Until they are so required, and accurate death records are gathered, all departments of sanitary science in this country will suffer.

The South Fork Dam and Johnstown Disaster.

The Johnstown disaster occurred on Friday, May 31, the dam breaking, as nearly as we can determine, a few minutes after 3 P. M. There is still some conflict of evidence as to the exact moment, but less as to the fact that 17 minutes later the flood struck Johnstown. Communication by rail with the main line of the Baltimore & Ohio Railroad was established on Monday, but it was not till Tuesday, June 4, that through communication from New York via Baltimore, Washington, and the Rockwood-Johnstown branch of the B. & O. R. R. was established, the main line of the B. &. O. R. R. having suffered very severely.

Two members of the editorial staff of this journal, provided with compass, hand-level, tape-line, and camera, left New York at midnight Tuesday, reached Rockwood about midnight Wednesday, much behind the regular schedule, slept on the clean hay of a dirty barn with gladness and thankfulness of heart, about half the crowd of arrivals being less fortunate, procured three dozen Rockwood sandwiches, on which they lived for the next two days, and on Thursday morning, June 6, at about 8 A. M., arrived in Johnstown, proceeding thence on foot up the desolated valley, with Mr. S. T. MILLER, M. E., of the Lidgerwood Manufacturing Co., and another recruit to assist in measurements, to the broken dam, which they reached the same evening.

What they saw en route, and the general state of the valley, we cannot attempt to describe and illustrate in this issue. The greatest point of interest to engineers about the disaster is the dam which caused it, and space and time are sufficiently taxed to present the facts in regard to that structure as completely as we do in this issue. Next week we shall endeavor to describe with equal care the effect of the flood in the valley, and the technical facts of interest to engineers connected therewith.

We give elsewhere our general conclusions as to the structure, and here merely describe our engravings and the facts connected with them.

We present herewith in Fig. 1 an accurate map of the valley, showing also the water-shed of the South Fork above the dam. The latter, as we give it, aggregates by a planimeter measurement 50.63 sq. miles, this measurement having been made to a scale of 1¼ miles per inch on the original county map which we were fortunate enough to discover in the old archives of the firm of G. W. Colton & Co., but for whom we should probably be able to present to our readers only the inaccurate maps which alone, so far as we have been able to observe, have appeared elsewhere.

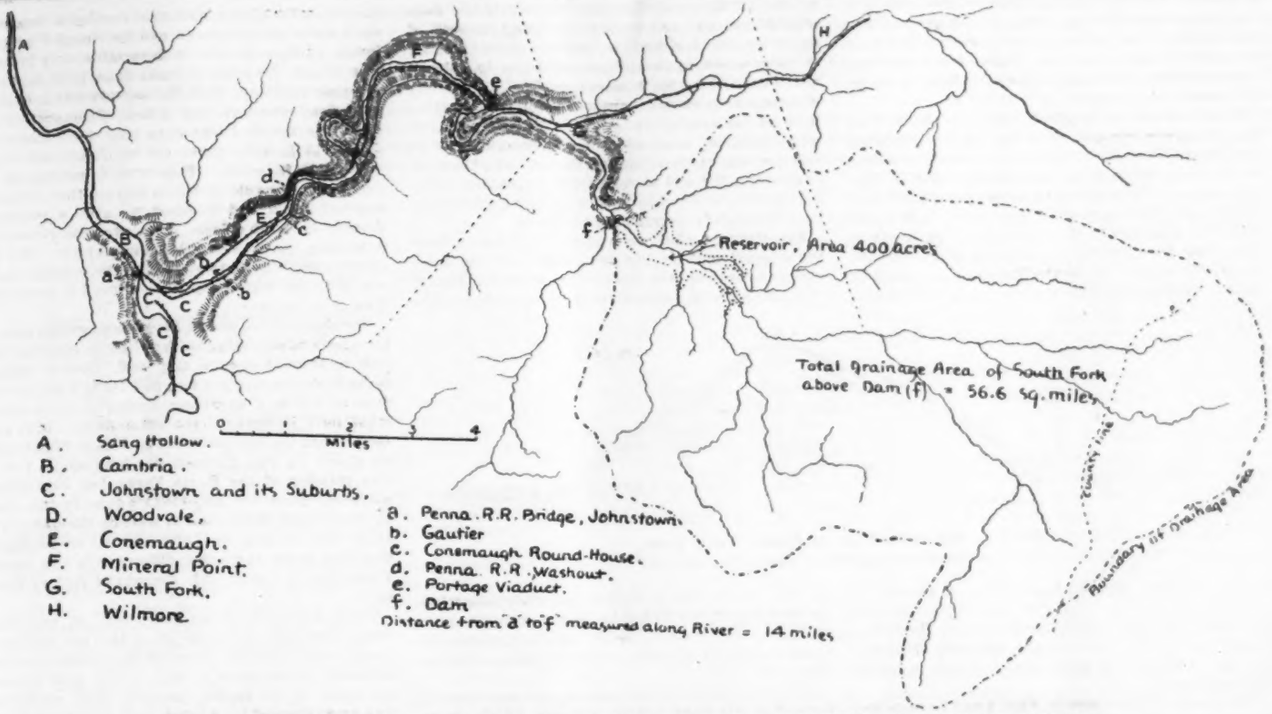
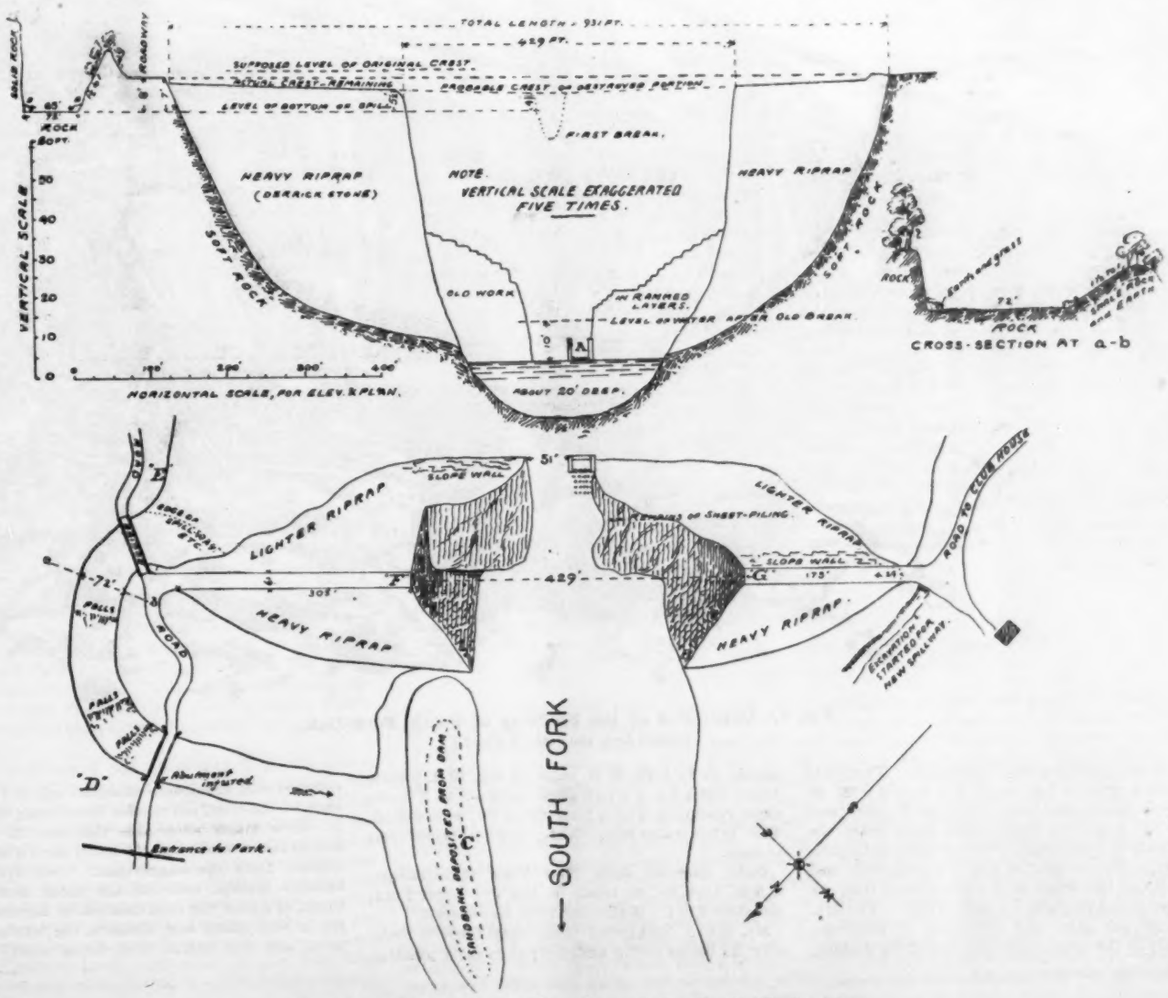


Fig. 1. General Map of the Region of the Johnstown Disaster and the Watershed of the South Forks.

[This map is the first correct one published, the decided differences between it and those which have as yet appeared elsewhere being due to inaccuracies in the latter. It is reproduced, by kindness of G. W. Colton & Co., from an old and scarce county map of 1867, on a scale of 1¼ ins. per mile. The topography on this map is made accurately to scale from sketches made on the ground.]



Figs. 2 and 3. Plan and Elevation of the South Forks Dam.

(Drawn from surveys made on the ground, by members of ENGINEERING NEWS Staff.* Letters C to G inclusive represent points from which views were taken.)

The true area of the watershed, however, we take to be more nearly 60 sq. miles, since it extends over into Bedford Co., and of that we have not had time to search for a county map. Some statements have appeared that the watershed was only 26 sq. miles. These are very incorrect.

The reservoir as originally designed, as will be seen from the extracts from old reports published last week, was to be of 400 acres, confined by a dam 62 ft. high, 850 ft. long, and costing $188,000. The dam as actually made was somewhat higher and longer, as will be seen from Figs. 2 and 3, and cost $240,000. This would of course make the reservoir larger, but it cannot have been much larger, because the whole land owned by the State and conveyed by it, through Congressman JOHN REILLY, to the South Forks Hunting and Fishing Club, as elsewhere detailed, was only a little over 500 acres, and this included a good deal of unflooded area. We have, therefore, continued to call the reservoir 400 acres in our computations elsewhere. It was possibly 430 or 440 acres.

The plan and elevation in Figs. 2 and 3 are as accurate as could be measured with tape line, hand-level, and pocket compass only, and we think will be found to err in no important particular. We should have much preferred to make the survey with an engineer's transit and level, but it would have been impossible to get the instruments there under the then existing conditions, while certain unimportant details, like the precise plan of the spillway and the width of the break at the lower water line, we were compelled to slight for lack of time. The substance of the plan and elevation is accurate, especially in the most important fact of the dishing or sag of the crest line, but for which the dam would have had an excellent "fighting chance" of surviving intact, since it would have given 1½ to 2½ ft. more water in the spillway, and this in spite of the obstructions in it shown in Fig. 7. All our drawings are accurate reproductions of photographs, both having been made by Mr. F. P. BURT, C. E., of our permanent staff, who, most fortunately for us and for our readers, unites the qualifications of engineer, artist, and photographer, so that the faithful representation of salient engineering details has been throughout carefully attended to.

Fig. 4 shows what we regard to have been both the original and present cross-section of the dam, except as regards the interior, as to which Fig. 5, reproduced from a contribution to our issue of Nov.

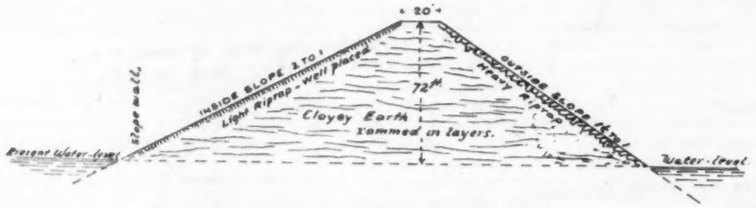


Fig. 4. Cross-Section of South Fork Dam.
[Interior construction doubtful. See text and Fig. 5].

17, 1888, by Mr. WM. J. MCALPINE, represents what we have finally concluded to be the stronger probability. We have made every effort to recover the original plans of the dam, but have been as yet unable to do so.

We have recovered drawings of two very similar dams of nearly equal height, however, which are as follows:

De Ruyter reservoir dam, New York State canals, 72 ft. high, 20 ft. wide on top, 20 ft. puddle heart wall; 3 to 1 lower slope turfed, 2 to 1 inside slope riprapped with a level bench 6ft. wide added, 15 ft. below water line. Water line 8 ft. below crest of dam.

Cuba reservoir dam, New York State canals, 51.6 ft. high, 9½ ft. thick on top, dry slope, 2 to 1, wet slope 3 to 1. Water line 10 ft. below crest.

Mr. WM. J. MCALPINE, than whom there is probably no better living authority as to early practice in dam construction, and who has built dozens of such dams as the above and the South Forks, informs us that the almost invariable early practice was to put the crest of earth dams 10 ft., and that running roadways over the top was rather encouraged than otherwise with a view of compacting the top. The South Forks dam may have been designed 10 ft. high above the spillway, and with a 10 to 12 ft. crest. This would correspond to what one or two old residents told us, that the crest was cut down and widened to give a roadway. Some of the Club officers, if reported interviews are veracious, have said the same thing. We incline to the belief, however, that the original dam, was designed with a top 20 ft. wide, 8 ft. above the bottom of spillway.

The slopes of the South Forks dam will be seen to have been considerably bolder than in either of the two mentioned, and we may add, than is usual; being 2 to 1 on the wet face and 1½ to 1 on the dry face, or 3½ to 1 aggregate, against 5 to 1 or somewhat over in both of the other dams. It is also bolder than the type preferred by WM. J. MCALPINE, as shown in Fig. 4, which has both slopes 2 to 1. The interior of the South Forks dam also differs markedly from Mr. MCALPINE'S type in this, that the lower part of the dam as well as the upper was earth and nothing else, although we do not know that this made any great difference in the result. There was no considerable amount of rock or stone in it.

There was certainly no heart wall of any kind, masonry or puddle, in the dam, and our sketch of probable cross-section, based on the estimates which appeared in last week's issue, was in that respect incorrect. If the rubble masonry thus estimated was ever intended for a heart wall, that part of the design was changed. Also, so far as can be judged from the evidence of the remnants, the carefully rammed part of the dam extended only to the *upper* edge of the crest, not to the lower edge, as in Fig. 5. How much better able this part of the dam was to resist wash than the lower part, is strikingly evident from the engravings. Two very heavy benches remain, over *all* the upper surface and edges, of which the stratification in horizontal layers is still sharp and distinct, the surface being hard, and the breaks in it being nearly vertical

Fig. 7. Upper End of the Spillway of South Fork Dam.
[Taken from the point E, Fig. 3.]

down to the next layer. The whole of these benches could be walked over like a flight of steps.

Of course the rush of water may have cut away the lower part of this rammed part of the dam; but fact that its inner edge is nearly vertical under the upper edge of the crest, and in no part extends beyond it, while at points this edge falls short, indicates that the rammed portion did not extend much beyond the center of the roadway, at least.

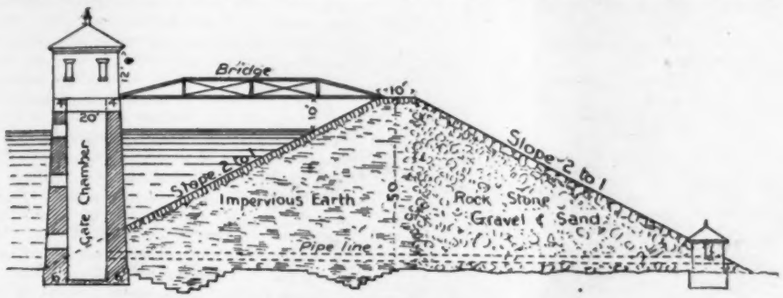


Fig. 5.—Cross Section of Earthen Dam, Gate Chamber, etc.

Recommended by Mr. WM. J. MCALPINE in our issue of Nov. 17, 1888, as the safest type of Earthen Dam and apparently much the same as that, used for the original construction of the South Forks Dam, with certain differennces.

Most of the upper part of the roadway, however, seems to be new work; and it is possible that the roadway and inner face of the rammed portion was extensively broken down before making the repairs, as noted in our editorial on the dam.

The riprapping on both slopes was exceedingly well done on the parts now remaining. How well it was done on the new part, which was washed out, we have no means of judging, but we infer from eye-witnesses' accounts that it was fairly well done.

The original estimates were for half earth and half rock and slate spoil. We can readily understand how this could be, and yet the dam be made practically all of earth. A rotten, slaty shale rock lies close beneath the surface, which for a foot or two disintegrates into earth almost completely after excavation. It was probably contemplated to excavate half the material from this soft rock, and a good deal was so excavated, but the large borrow pits on each side at the bottom of the reservoir indicate that a good deal of material was taken from lower down on the valley slopes, where there was more earth and perhaps a rottener rock. Be this as it may, there was hardly a piece of rock as big as a man's fist in any of the central part exposed to view. The lower edge of the northeast side of the gap showed an interior coating of spalls, as outlined in Fig. 9; but while these may be the outer evidences of a similar lining extending along the old work, inside the heavy riprap, it is more likely that it is a mere exterior coating of a few stones, which chanced to lodge there in the washout or fall from above. There is no similar evidence of interior stone in the southwest end, Fig. 10.

There was an arch culvert carrying 5 24-in. discharge pipes in the old dam, and some settlement of this culvert, or leakage around it, caused the first break, which occurred in July, 1862, after the reservoir had been abandoned four years. The residents around had been stealing lead from the pipe-joints extensively during these four years, and this is the cause which is locally assigned for the first break, and is, perhaps, more correct than the one, given elsewhere, assigned by the division engineer, who cannot have been greatly concerned to ascertain the facts about a dam no longer in use. The letter from the venerable W. HASELL WILSON, now President of the Philadelphia & Erie Railroad, which appears elsewhere, gives some details as to the first break.

The evidence of our old county map, and also a little tuft of water vegetation still remaining in the bottom of the reservoir, shows that the old break was not so extensive as to prevent the continual retention of a little pond 10 ft. above the present level of the water at the dam. The old culvert pipes also remained practically intact, although the culvert was in bad condition, and washed out at the lower end; and when the reconstruction of the dam for pleasure purposes was determined on in 1879-80, under circumstances explained in our following editorial, and which should be known to properly follow this description later, it was naturally and judiciously determined to close this opening altogether. This action would have tended distinctly to safety, had it not been accompanied by the great error of neglecting to be correspondingly more cautious as to the spillway area provided at the upper water level. As a matter of fact, the rebuilders, *who were aided by no engineering advice or supervision whatever*, as we elsewhere point out, were greatly less cautious about the spillway area instead of more so.

The wreck bears plain evidence as to the manner of closing the old culvert gap. A row of very flimsy and poorly driven hemlock plank sheet-piling, in a double layer, was driven across the opening, under about the middle point of the wet slope, as indicated in Fig. 3, the remains of the old pipe culvert being at A. This pipe culvert, by the way, appears to have been a very carefully built structure, of cut stone, with heavy stone blocks, having five almost semicircular rests cut in them to carry the pipes, these rests being 6 ft. between centers longitudinally.

About 14 of the old hemlock sheet piles still remain, and are faintly visible in Figs. 6 and 9. Of these, two or three were 1¼ ins. thick and the rest 2 ins. They bore no evidence at the top of having been very solidly driven, and in fact such planks cannot be solidly driven and hold together. It was through this part of the dam that there was a good deal of continuous leakage. The old Dutch farmer who lives just below the dam told us that there was always a small stream of water coming out below the dam. He apparently spoke relatively to the natural flow, however, which is pretty large, and we should judge that there was always far more water leaking through than was healthy for a dam. We could gather no evidence that this leakage had been increasing until just before the break. During reconstruction and just after it, leakage was heavy and gradually decreased. A large amount of hay and straw was used to stop these leaks, which in itself was not improper. As an evidence of how the reconstruction work was done, however, it is significant.

As to the earth in the rammed benches, we should judge it to be fairly good puddling material, but hardly of the best class, not being quite clayey enough. It seems to have stood well, and had the whole dam been constructed and *reconstructed* in similar rammed layers, the disaster might have been greatly alleviated, but still hardly avoided. If in addition the lower slope had been 2 to 1 instead of 1½ to, 1 with a heavy riprap all over it, as still remains on the end portion which is very heavy and good water might have run over for some little time without destroying the dam, except for the sag in the crest.

As to that sag: In our elevation, Fig. 2, we outline the evidence from which we draw the grave deduction that the center of the crest was little if any more than 4½ ft. above the bottom of the spillway. Our study of the structure led to these conclusions as to this vital question: The crest originally was 8 ft. above the spillway (by which we mean in all cases the bottom of the spillway). The bulk of the earthwork having been done in 1840 ($80,000 had then been expended), and the dam not completed till 1852, it had ample time to settle. From 1852 to 1858, the dam was in care of the State and probably well maintained, but possibly there might have been a slight central settlement even then. In 1862 the break occurred, and from 1858 to 1880, or for 22 years, the dam was wholly uncared for. During this period, by wash alone, the crest would lose considerable, height and naturally more near the center than at the ends. We judge that by 1880 the crest had substantially the same dip that it has now, which is about 1½ ft. (7 ft. to 5½) in a distance of 305 ft. The dip would not attract an unprofessional eye: the crest still looks level, and good enough to work to for reconstruction, although the dip is clearly discoverable in Fig. 9, which was taken by a small camera resting directly on the crest of the opposite bank. Everything indicates that the northeast bank still remains substantially unchanged since original construction. The washed out portion was probably restored in 1880 working to the old top as a grade line. If so, the grade of the old portion, prolonged to the center of the dam,

Fig. 8. View of Spillway from Below.

[Taken from the point D, Fig. 3.]

would give less than 4½ ft. above spillway at the center; but allowing this not to have been done, the new work was comparatively carelessly and loosely built. It would, therefore, settle while the old part did not, and its settlement would not be noticed, because the crest line would simply prolong the old lines.

That this was substantially the case seems to be proved positively by another fact. A foreman and 25 men were employed for hours before the break, trying to save the dam. They plowed furrows on the lower edge of the southwest crest, and used the material to raise the crest by a temporary bank. This bank at least would be level, because they had the water to give grade. On the northeast end, there was and still is (if it has not been removed) a remnant of this bank, in a rough little mound, which looks as if it had been made by children playing there. It is about 6 to 8 ins. high, and 12 to 18 ins. wide at the largest end, near the break, tapering out to nothing in a distance somewhat over half the length of the remaining bank. It is very irregular, and its total contents, calling it a triangular pyramid with 8 x 18-in. base and 150 ft. long, is less than a cubic yard. It would not take 25 men long to throw up this embankment, which is faintly indicated in Fig. 9, and was barely discernible in the photograph from which Fig. 9 was prepared. What were the gang of men doing with the rest of their time? They now say the mound was 12 to 18 ins. high in the center of the dam, but their memory is evidently not clear; it might have been considerably more or less than this. Be this as it may, the fact remains that *water ran over the dam in a broad sheet for two hours before its final and sudden collapse, and in volume sufficient to destroy the dam without hurting or touching this slight mound.* Had there been any water running over at a level high enough to cut it away at the end, it would all have gone away by quick abrasion, since it bears no marks of having been solidified or smoothed over by the flood at all, and when wet must have been a mere loose heap of mud.

From this our conclusion is that the top of the sheet of water which destroyed the dam was at no time sensibly higher than the base of this remnant of embankment, which is at the level of the crest at *F*, or about 5½ ft. above the bottom of the spillway. As the sheet of water must have been at least a foot thick to do the work it did in the time it took to do it, the resulting conclusion is obvious.

In Figs. 7 and 8 we show the spillway from two points of view; the most important, of course, is

Fig. 9. View of Northeast Remnant of Dam, taken from the Level of the Crest at Southwest End.
[The point G, Fig. 3. The dishing of the crest is clearly evident in this cut.]

Fig. 10. View of Southwest Remnant of Dam.
[Taken from the point F, Fig. 3.]

Fig. 7, which shows how the spillway had been obstructed. The bridge had been built to carry a driveway over, as also the lower bridge near the point *D*, Fig. 3. Attached to the posts of the bridge were, first, a row of iron gratings to serve as fish-guards, and secondly a floating 8 x 8 stick; armed on the corners with a double row of nails, to serve as additional fish-guard, and keep fish from jumping over. The fixed grating was 18 ins. high, rested on a wooden sill projecting about 2 ins. above the floor of the spillway, and was made of ¼-in. rods ¾ in. apart in the clear, or 1¼ ins. between centers. The floating stick was armed with an iron eye at each end sliding on a vertical rod attached to the bents of the bridge; so that it could rise and fall with the water level, floating in the water cornerwise. Another similar stick of an Λ form, braced across the angle, was arranged in front of the bridge in some way we did not clearly determine; possibly both sticks were all one exterior guard, and during the flood had broken loose or been cut loose, and knocked out one of the posts of the bridge, as our engraving shows. Some of the fixed gratings have been knocked down since the disaster, and do not show in our engraving, but they extended clear across. There was also a number of finer wire netting guards, like that shown at the right of Fig. 7, which had apparently been placed above the fixed grating to further guard against the escape of fish, but were removed during the flood. The log in the foreground of Fig. 7 speaks for itself, but there were fewer small obstructions of leaves and brush in front of the gratings than we should have expected. What there was when we examined the dam was insignificant in amount. The normal water stage in the spillway was indicated very clearly by water marks in the gratings as 9 to 12 ins. above the bottom. The gratings were fixed and not swinging, as has been stated. We looked with care for some maximum water mark left by the flood, but found none, as is not unnatural, since lake water, even in floods, is clear. Had it been river water, there would doubtless have been clear marks.

We estimate elsewhere the net rise of reservoir level caused by these spillway obstructions at one foot, and we do not think this estimate can be too high when we consider the probable great velocity of 15 to 20 ft. per second.

Fig. 8 shows the lower part of the spillway and the excavated falls therein. Just below the foreground there was another and very high fall a little above the lower bridge, the abutment of which had been badly injured. It might have been injured before, but it is more likely this was the severest flood to which it had been exposed, and that its injuries were recent. No part of the spillway visible in Fig. 8 has been widened since first built, if the moss-grown rock slopes overgrown with bushes and trees, tell the truth. The extreme upper end of the spillway had been bell-mouthed about 10 ft., where the upper bridge crosses, apparently with the idea of counteracting in this way the loss of discharging capacity from the obstructions. In a sense it would do so, but, as we have pointed out elsewhere, not without raising the lake level nearly as much as the same obstructions would have done in a narrower part of the spillway, the only difference being that due to the smaller velocity required at the wider point for the same discharge.

Figs. 9 and 10 show end views of each end of the dam taken from the crest level of the opposite ends. Fig. 11 gives a view of the broken dam from the upper side. These views need no further comment or explanation than we have already given here and elsewere.

Fig. 6. General View of South Fork Dam.
[Taken from the point C, Fig. 3].

THE USE OF METAL TIES on German and Prussian railways is noticeably falling off, according to our German exchanges. Some of the writers ascribe this to a desire on the part of the Government to favor the owners of beech forests; and in support of this note that, since the discovery that treated beech-wood made a serviceable tie, its consumption rose suddenly, in 1883-84, to 46,153. But it is also shown that but a small percentage of beech ties used in 1884 came from German forests. In 1887-88 the consumption of metal ties on the Prussian railway systems fell off 7.86 per cent., and on German roads 7.13 per cent. from the consumption of 1886-87. It is estimated that in the last year about 1,800,000 oak and pine or fir ties were imported into the Empire.

Dudley's Track Inspection Diagrams.

The accompanying large diagrams give an example of the track inspection records taken by Mr. P. H. DUDLEY with his ingenious track inspecting car, which we are satisfied has done great good in raising the standard of track on many roads. The ejection of paint on the precise poin. needing repairs is an entirely novel feature, and appears from experience to give quite accurate indications of real defects. No doubt occasionally spots not really defective are marked as such and really defective spots missed; but all accounts agree, so far as they have come to our knowledge, that in the main the paint spots go where they ought to go. Mr. DUDLEY has labored many years and through many discouragements in perfecting his apparatus, and we are glad to know that his labors and studies have been of late years properly appreciated, and have brought their proper reward in much occupation. The very great effect which such position records as that which we reproduce are likely to have in giving the interest and zest of emulation to the monotonous duties of the trackman is so apparent that it is needless to do more than refer to it. Without some such system of inspection, it is a difficult thing for a man to keep enthusiastically interested in perfecting track which he does not ride over, on $45 a month or so. The interminable labor of keeping up what is continuously running down is one, which from its very nature, tends to create a certain apathy, in most of the section foremen at least. Those who stand high enough to aspire to a roadmastership may persevere, and there is perhaps no class of men who have more of the spirit of fidelity for its own sake than the humble track foremen, as the late CHARLES LATIMER was fond of asserting. Nevertheless, every man, to do his "level best," needs the double stimulus of probable credit for good work, and probable discredit for bad; and this the track inspection apparatus gives.

The diagrams which we reproduce are accompanied by the following "General Explanations," which save us the need of further comment. A communication from Mr. DUDLEY in another column is also of interest in this connection.

Diagrams representing various details of each track, as obtained by mechanical inspection, are shown upon the engraving for each division.

Rails on the track are found in quite definite forms as to their surface, due to permanent bend, which are either first, directly traceable to want of care in their manufacture, or secondly the bends acquired afterwards in the track.

The *form* of rails in the track is generally that of one of the types represented by cuts Nos. 7, 3, 2, and 1.

Cut No. 7 represents the rails which are best finished as they come from the mills, and which are only found in the best-surfaced tracks. Cut No. 3 represents a poorly-finished rail, the surface being wavy or full of short kinks, and making a more unpleasant riding track than low joints. Many rails, especially on curves, wear more or less irregular on the surface, like cut No. 3, but the base is not so uneven.

Cuts Nos. 2 and 1 represent forms of rails as acquired in service. Such forms are not as frequently met now in aggravated degree as a few years since.

Cut No. 4 shows, to some extent, the characteristic deflections or undulations which even the smoothest rails assume under the wheels of locomotives and cars, due to looseness, unequal bearing on all the ties, and want of stiffness in the section of the rails. The magnitude of the deflections is least on the 72-lb. rails. It slowly increases with the age of service of the rails, from the fact that stiffness of the rails is decreased by the loss of metal from the head and base.

From the above it will be readily understood that the undulations of the rails in the track may be due to one or a combination of several causes, to wit:

1. Short bends in the rails from the mills.
2. Roughness of the rails from unequal wear.
3. Long bends in the rails.
4. Low joints.
5. Deflection of loose rails, worn joints, and ties.
6. Rails cutting into the ties.

On the large diagram the "Condition of Track" line for each inspection represents the average sum of *all* the various undulations of the rails per mile, and, as it is relative to a common base line, also shows the comparison of one mile with another.

The average condition of each mile is indicated by the horizontal line, which is crossed or touched by the "Condition of Track" line in the center of the space for the mile.

Lines marked "Age of Steel" for each mile give its length of service, each horizontal space representing one year.

Line marked "Percentage of Tangent and Curve" shows the approximate alignment of both tracks per mile. The percentage of tangent is marked on the left side of the space for the mile, and that of the curvature on the right side. Each horizontal space represents 10 per cent. for the mile.

Line marked "Profile" shows the gradients of the road, and is common to both tracks, though ascending grades on one track are descending upon the other and *vice versa*.

Lines marked "Gauge of Track" read downward from the base (70th) line, and show the amount the track is out of gauge, each horizontal space representing one-tenth of one inch; a point projecting below the general average indicates that on some curves two or three rails are much wider than the rest, and usually will be found on the lower rails.

Lines marked "Side Irregularities of the Rails," just above the base line described, represent the side irregularities of the rails, each horizontal space representing one-tenth of one inch. This line reads from the highest point in the center of the space for the mile.

Three spaces are about the best results which can be attained.

Fig. 1.—First Forms of Permanent Set.

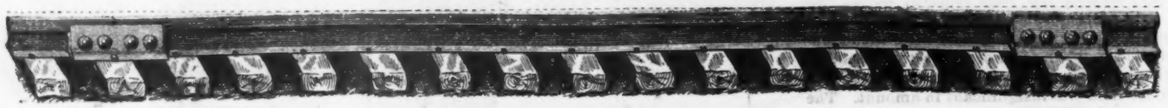


Fig. 2.—Second Form of Permanent Set.

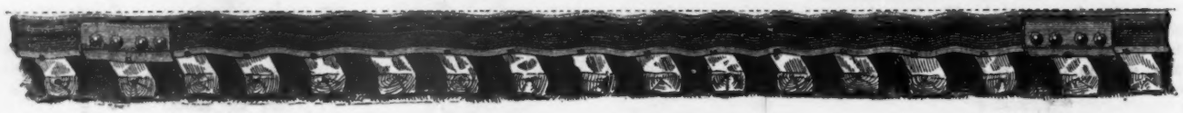


Fig. 3.—Third Form of Permanent Set.

Fig. 4. Depressions below Dotted Line Show Deflections in the Best Tracks under the Wheels of the Locomotives and Cars.

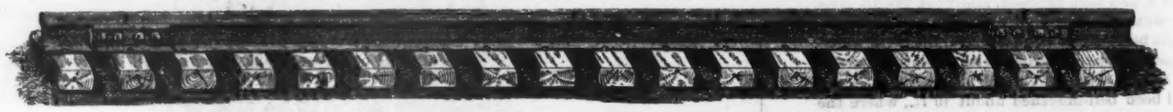
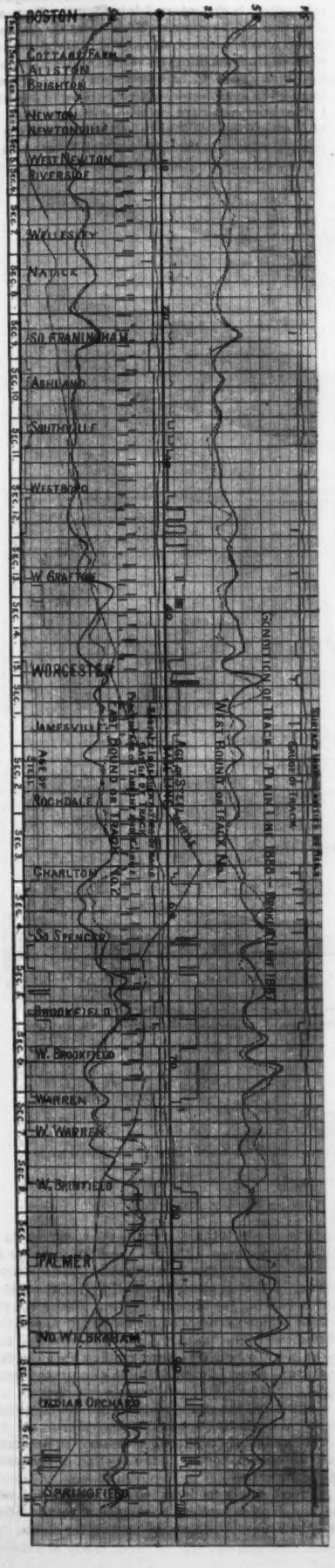


Fig. 7. Fourth Form; Best Condition of Track.

The track gauge should be frequently applied to the track, especially on curves.

ELECTRIC TRAMWAYS AT FACTORIES.—A need of better facilities for handling supplies, etc., in large manufacturing establishments has led to the adoption of tramway cars propelled by electric motors. As many large mills are supplied with electric light, the use of this system will probably be greatly extended. The Thomson-Houston Co. has equipped several tramways of this sort, and has contracts for others. At the works of the company at Lynn, Mass., an electric car is used for moving heavy machinery to different parts of the works, and enables such heavy pieces to be moved with greater ease and in less time than by any other system. The car has two 3 H. P. motors and can take a load of 5 tons up a grade of 13 per cent., or 8 to 10 tons on a level. Power is taken from an overhead wire from one of the generators in the factory.

A COPY of the special edition of *Le Figaro* printed among the clouds in the Eiffel tower shows that Mr. H. KARLES, of Milwaukee, Wis., was the first visitor to ascend the Eiffel tower and record his name in the big visitors' book after M. EIFFEL and M. SAUVESTRE, the architect, had opened it.


BOSTON
COTTAGE FARM
ALLSTON
BRIGHTON
NEWTON
NEWTONVILLE
WEST NEWTON
RIVERSIDE
WELLESLEY
NATICK
SO FRAMINGHAM
ASHLAND
SOUTHVILLE
WESTBORO
W GRAFTON
WORCESTER
JAMESVILLE
ASPEN
ROCHDALE
CHARLTON
SO SPENCER
BROOKFIELD
W BROOKFIELD
WARREN
W WARREN
W BRIMFIELD
PALMER
NO WILBRAHAM
INDIAN ORCHARD
SPRINGFIELD
CONDITION OF TRACK — PLANTED IN 1880 — WEIGHT OF RAIL
WEST BOUND MAIN TRACK
EAST BOUND MAIN TRACK
SIDING
SIDING
SIDING

Elmira, N. Y.—Earth, 36 ft. high, 1,100 ft. long, 10 ft. wide on top, and is paved with stone on inner slope Impounds 100,000,000 galls.

Goshen, N. Y.—Earth, 37 ft. high, 260 ft. long, and 12 ft. wide on top. Impounds 46,000,000 galls.

Kingston, N. Y.—Earth, 35 ft. high, 195 ft. long, with heart wall of masonry founded on rock.

Pottsville, Pa.—Earth, 35 ft. high, 1,300 ft. long, 40 ft. wide on top, with slopes of 2 and 2½ to 1.

Baltimore, Md.—*Gunpowder River Dam;* stone, 34 ft. high at overfall, and 8 ft. higher at wings. Overfall is 300 ft. long, and wings extend some distance farther.

Newport, Ky.—Earth, 35 ft. high, with stone paving on the slope. The full capacity of the dam is 45,000,000 galls., but in June, 1875, it suddenly emptied, owing to breakage of drain pipes; later, the effluent pipes settled, causing leakage, and the embankment slid in. Owing to these troubles, and others, only 16 ft. of water is now stored.

Moncton, N. B.—Earth, founded on solid rock; 35 ft. high and about 400 ft. long, with puddle core 15 ft. wide at bottom and 10 at top.

Safety Lock for Split Switches.

The accompanying engravings show the general plan and details of a cam lock for split switches, which is used on the Lehigh Valley Railroad on all facing point switches on double track, and on all switches on single track. The device is so simple in its details and so fully shown as to need little explanation in addition to the drawings themselves, but it is an excellent detail, which is giving entire satisfaction on the Lehigh Valley road, and deserves wider use. The padlock which is attached to the switch is, as may be seen from Fig. 1, attached to the lever which moves the locking rod carrying the cams, so that the switch cannot be locked with the padlock unless the cams are in position. These cams, in turn, cannot be brought into position unless the point rail is close against the main rail, and when they are in position hold the point rail positively locked, so that by no possibility can it be misplaced even if a derailed wheel breaks the main switch rod. The cam lock is not used on trailing points, for the evident reason that it is better to leave the points free to move in case of a train running through the switch while misplaced. Locks of this general nature are nearly always used with interlocking apparatus, but are the exception with independent switches.

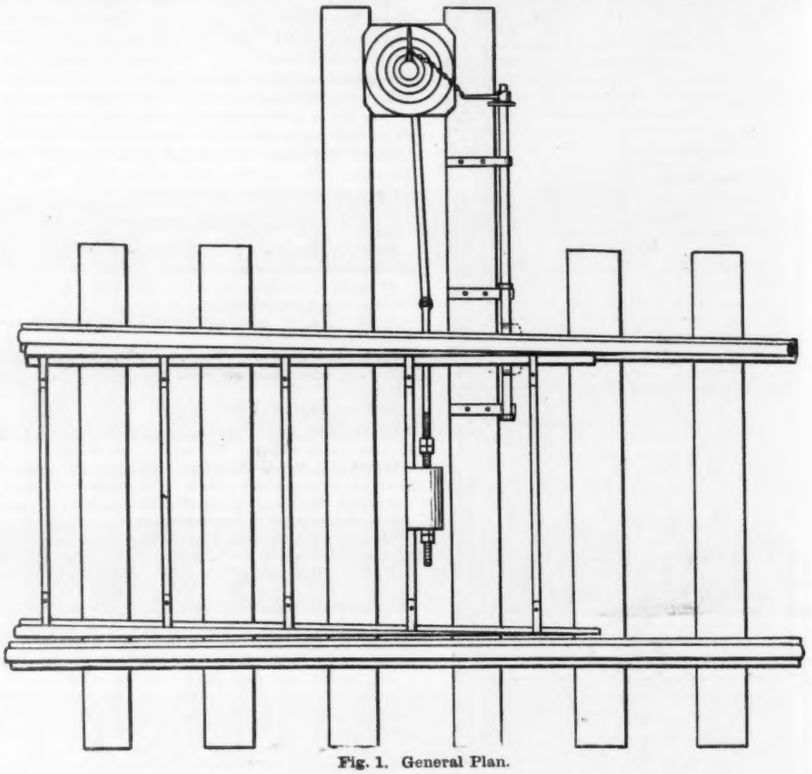


Fig. 1. General Plan.

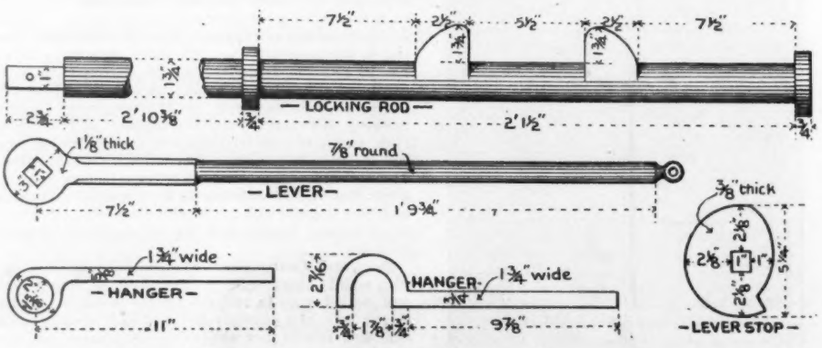


Fig. 2. Details.

Safety Lock for Split Switch, Lehigh Valley Railroad.

The Lion of the Paris Exhibition.

A correspondent writes us as follows concerning the Paris Exhibition:

Undoubtedly the most attractive feature in connection with this vast world's competition is the famous Eiffel tower.

Upon it daily turn the eyes of almost half a million of people, from nearly every country under the sun, among whom may be found men holding the first rank in art and science in their respective nations. Among this immense concourse of people, in operative and scientist alike, there is one feeling in common,—that of admiration for the structure, and astonishment at its stupendous height.

It is indeed a marvellous structure, bold in conception, chaste in design, and daring in execution, yet, withal, it does not impress one with the feeling of stability and permanency, its spiderlike ironwork having quite the opposite effect. It is undoubtedly a daring departure from the generally accepted rule by which materials are proportioned to the heights, sections, and conditions of the structure in which they are to be employed. The ironwork entering into the Eiffel tower is said to exceed 7,500 tons; yet when its enormous base, though perforated at right angles with stupendous arches, is taken into account with its height, the quantity seems to err on the side of scantiness, and I am strengthened in this view by the experience I have had in ascending to the second stage of the tower, and descending from it, to-day.

At eleven o'clock this morning the tower was thrown open for the first time to the inspection of visitors, but permission to ascend was limited to the second stage, beyond which no one was permitted to pass. This stage or gallery is only 115 metres from the ground, and is from its situation in respect to the supports perhaps the strongest point in the whole structure, and it may be correctly said that the tower proper only commences here. This will be readily understood from the diagrams that I forward to you and which you may consider worth reproduction. The visitors were obliged to ascend by the stairs, darting backward and forwards through the tangled maze of lattice girders which form the struts and stays to the main angle pieces and body of the work. The lifts which are to be used for the purpose of ascending and descending are not yet in readiness even for the second stage, so that for some weeks to come the preparations to enable visitors to reach the top will not be effected.

Although great curiosity was manifested by the public to explore the mysteries of the Eiffel tower, still many were deterred from making the ascent by reason of their having to ascend to such a height on a comparatively unprotected stairway. The stairs were railed in sufficiently high to prevent people from falling, though the view to the bottom was scarcely anywhere interrupted I ascended the stairs to the first stage, which is an immense balconied gallery, occupied by cafés, photograph stores, restaurants, etc. During the time that I remained on this gallery a good many people arrived on it, and I made my ascent to the second stage.

I was followed by some forty persons, and for the first time I began to realize that their regular tramp on the stairs caused a certain amount of vibration. Having reached the second stage I found, as on the first one, cafés, etc., ready for making a trade which in less than half an hour afterwards were well patronized. But the most extraordinary occupant of this gallery is the enterprising *Figaro*. Here, at an elevation of 115 metres or 376 ft. from the ground, is a staff of compositors, stereotypers, and machinists, with engines dashing off at full speed the news of the hour, soon to be despatched for distribution among the anxious crowds patiently waiting below. I presented my card to the manager, and was courteously handed one of the first copies of the first issues of *Figaro in the clouds*, which I enclose to you.

The publishers of the *Figaro* opened a handsome register in which the visitors to the tower are to inscribe their names. Among the first—perhaps the very first of the names in this book is your correspondent's. I walked about this gallery for about three hours viewing the unparalleled beauties of the panorama which surrounded me on all sides, and then descended. The gallery, notwithstanding that there were over 200 persons moving about on it at the same time, I found it to be almost absolutely rigid.

I descended the stairs, which alternate in straight flights and winding spirals respectively.

This system is rendered necessary to accommodate the convex course of the outline of the inside of the structure.

A good many persons were descending with me, and I paid particular attention to the effect that their movements would have on the stairs.

The effect of the moving pile of people was, on the straight flights, a tendency to swerve slightly from side to side, and on the spiral columns a very active vibration from top to bottom, in fact so much so that in one instance some four persons before me actually shut their eyes and held on to the rail, believing that the stair was about to give way with them. It is of course well understood that a number of people exercise more weight in descending than in ascending, and it is to resist this affinity to the laws of falling bodies that the rigidity of a stairway should be calculated. But perhaps these stairs would have been made more rigid if it were contemplated to use them constantly as an approach to the galleries, and the fact that the service is to be performed by lifts may explain their apparent want of stability.

Before the Eiffel tower was erected, the highest iron building in the world was, perhaps, the *Flèche* on the cathedral of Rouen. The height of its top from the ground is 492 ft., but then the tower upon which it rests is of stone. The cast-iron pillars or supports of the *Flèche* descend through the grooves cut in the inner faces of the walls of the tower, a distance of about 30 ft., so that the absolute height of the ironwork is about 322 ft. This *Flèche* is of cast iron beautifully executed, and the pieces fastened together with screw bolts and nuts. I have visited it on frequent occasions during the past 25 years, to ascertain the effect of time upon it, I have ascended its spiral stairs from base to summit, and I have never been able to detect in it any defect caused either by time or construction. On my way to Paris on this occasion, I was more curious to visit it and inspect it than on any other occasion, owing to my desire to bring it into comparison with the great Eiffel tower. I am not sorry for having done so, for the comparison has impressed me w the idea that for vertical structures of a certain class, cast iron is far preferable to wrought iron, though perhaps it may not be quite so economical in quantity and cost. The Eiffel tower is all wrought iron, of very slight scantlings, and is secured with rivets. One thing is certain, however, that it is an extraordinary departure from the beaten path, and the enterprise and courage of M. EIFFEL deserves that it should succeed to the utmost degree.

DELTA.

Paris, May 15, 1889.

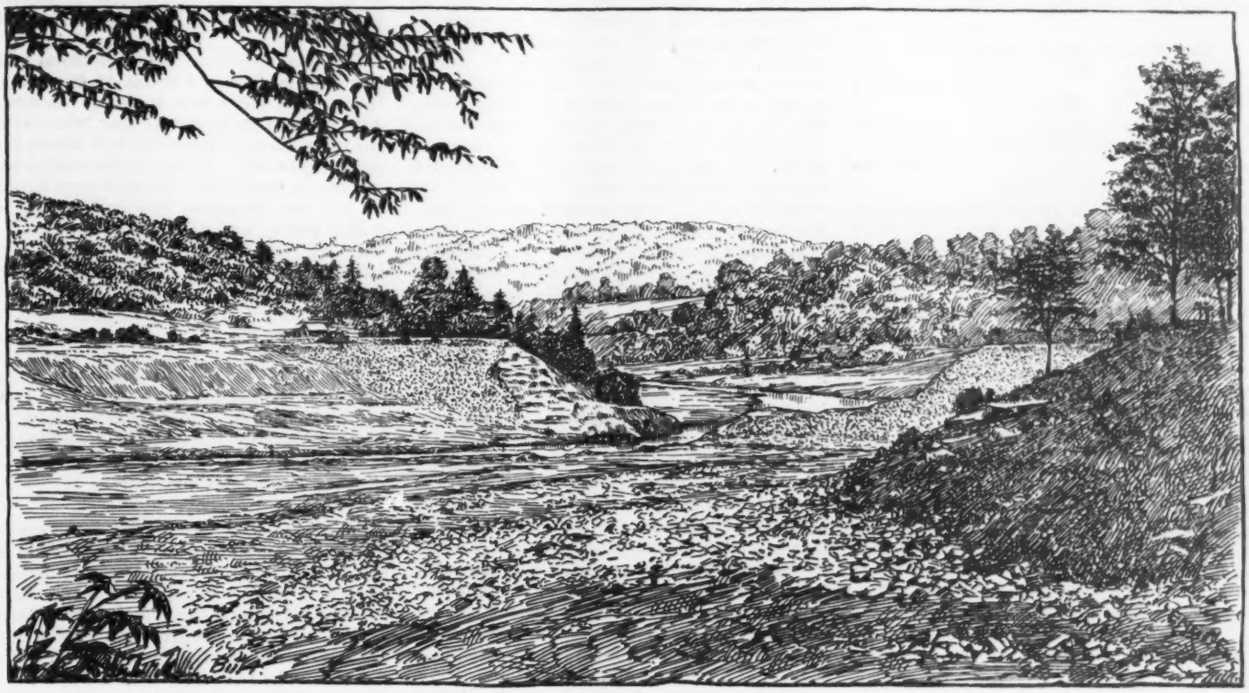
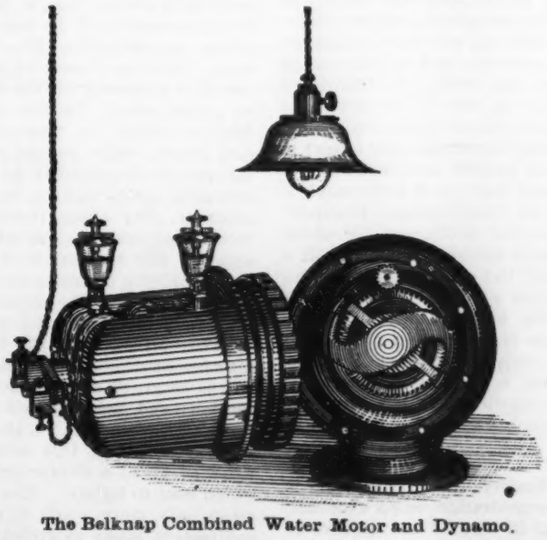


Fig. 11, View of Broken Dam from Upper Side.



The Belknap Combined Water Motor and Dynamo.

Electricity from Water Power.

The demand is great for some practical means of producing electricity from a power better adapted to the needs of small plants than steam, and it must be a power that will require little attention. The combined dynamo and water motor here illustrated and manufactured by the Belknap Water Motor Co., of Portland, Me., is claimed, with excellent endorsement, to most efficiently meet these requirements.

The motor is constructed on the principle of the turbine-wheel, with the dynamo on the same shaft. This arrangement has the important advantage of getting rid of belt friction or other loss in transmission of power. The speed of this motor is great, and it is thus specially well adapted for running a dynamo where high speed is an important requisite. The combination is compact and inexpensive, and is stated by users to be just the thing for lighting residences, stores, factories, halls churches and wherever an isolated, small plant is required.

The same motor is also adapted for grocers' use in grinding spices, coffee, etc., with an interchangeable arrangement enabling it to be used either as an electric or a water motor. As a water motor, the consumption of water is very small.

THE EDISON-SIMS TORPEDO, formerly known as the Sims, was recently tested at the proving ground at Willett's Point, Long Island, and although only a dock trial was made, it was eminently successful. By the introduction of an electric motor, fed by a dynamo on shore through two wires which also serve to guide and steer the projectile, a speed of at least 20 knots an hour has been reached. The range of the torpedo has been doubled.

THE STEAMER *Puritan*, which is to ply between New York and Fall River, on the Old Colony line, made her trial trip on June 13. She is a larger boat than the *Pilgrim*, built by John Roach four years ago. The *Puritan* measures 420 ft. over all, and 404 ft. at the water line. Her hull is 21 ft. 6 ins. deep and 52 ft. beam. Her engine is a compound vertical beam engine with surface condensers, developing 7,500 H. P. The high pressure cylinder is 75 ins. x 108 ins. The low pressure cylinder is 110 ins. x 108 ins.

ENGINEERING NEWS
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Subscription. — UNITED STATES AND CANADA, $5.00 *per Year*; $2.50 *for Six Months*; $1.50 *for Three Months*; *Single Copies*, 12 *cents*. FOREIGN COUNTRIES, $6.56 *per Year, or* 3 *cents per number additional.*

Drawings and Photographs *of all new engineering works or designs, large or small, of interest from their magnitude, novelty or originality, as well as newly adopted* **Standard Plans** *for engineering structures or details, rolling stock, etc., are always desired for early publication. Also,* **Brief Technical Notes** *of the cost or manner of executing work, tests of materials, machines or other new devices, and* **News of New Construction** *of all kinds.* **Letters** *for publication must be accompanied by the name or card of the writer.*

Drawings for publication *should preferably be in plain black and white, considerably larger than they are expected to appear, with letters and figures in pencil only, all lines clean and bold.*

Coming Technical Meetings.

Engineers' Club, Philadelphia, Pa.—Regular meeting, June 15. Secy., Howard Murphy, 1122 Girard St.

Engineers' Society of Western Pennsylvania, Pittsburg, Pa.—Regular meeting, June 18. Secy., S. M. Wickersham, Penn Bldg.

American Railway Master Mechanics' Association.—The annual meeting will be held at Niagara Falls, N. Y., beginning June 18. Secy., Angus Sinclair, 140 Nassau St., New York.

American Institute of Mining Engineers.—Next meeting at Denver, Col., beginning June 18. Secy., R. W. Raymond, 13 Burling Slip, New York City.

Boston Society of Civil Engineers. — Regular meeting, June 19. Secy., S. E. Tinkham, City Hall.

New York Railway Club.—Next meeting, June 20. Rooms 113 Liberty St., New York City.

American Society of Civil Engineers, New York.—Annual convention at Seabright, N. J., beginning June 20. Secy. John Bogart, 127 E. 23d St.

Master Car-Builders' Association.—The annual meeting will be held at Saratoga Springs, N. Y., beginning June 25. Secy., J. W. Cloud, Buffalo, N. Y.

Civil Engineers' Association of Kansas. — Regular meeting at the Association library, Wichita, July 3. "Foundations," H. H. Jackman. Secy., J. C. Hering, Main St. and Douglas Ave., Wichita, Kan.

THE whole engineering profession is to be congratulated on the fact which we are enabled to announce in this issue, and which we believe we were the first to discover, that no member of it, however humble, has a shadow of responsibility for the grave defects of structure by which the Johnstown dam has suddenly attained a fame second only to that of Vesuvius as a destroyer of life. That no engineer at all was employed, we did not dare to hope. It is truly amazing that there should not have been engaged, for a time at least, some young peg-sticker to set grade stakes, who called himself an engineer, and on whom the dread responsibility could now be shifted. In spite of our definite and authoritative information to the contrary, we shall not be surprised if our announcement of this fact, which we make in more detail in a following article, should bring out some claim that there was such a person employed for a few days. But even so, the essential fact will still remain unchallenged and unchallengeable, that no engineer of experience or standing, in responsible charge of work, however humble, lent any assistance in the plans for reconstructing the dam, or was asked to do so, and that no engineer of any kind was permanently employed. No grade stakes were needed, for there was the old crest of the dam to work by; no slope stakes were needed, for there were the old slopes to line by; and no measurements of quantities, because the work was not done by contract, but by a contractor, on his own account, by "day's work." As for paying for "judgment," the circumstances were peculiarly such as to make the thought of it seem absurd. A man of no experience in public works would not have dared to omit doing so; a man of more experience in hydraulic work, who knew what tricks water is capable of, would have been likely to call in the best advice he could get; but an old experienced railroad contractor, who had never (or "hardly ever") been engaged on hydraulic works, was of all men the most likely to have that little knowledge which is proverbially a dangerous thing, and in this case has proved so terribly dangerous. Not all such contractors would have been misled by it, by any means, but a larger proportion of them than of almost any other class would be likely to be so misled.

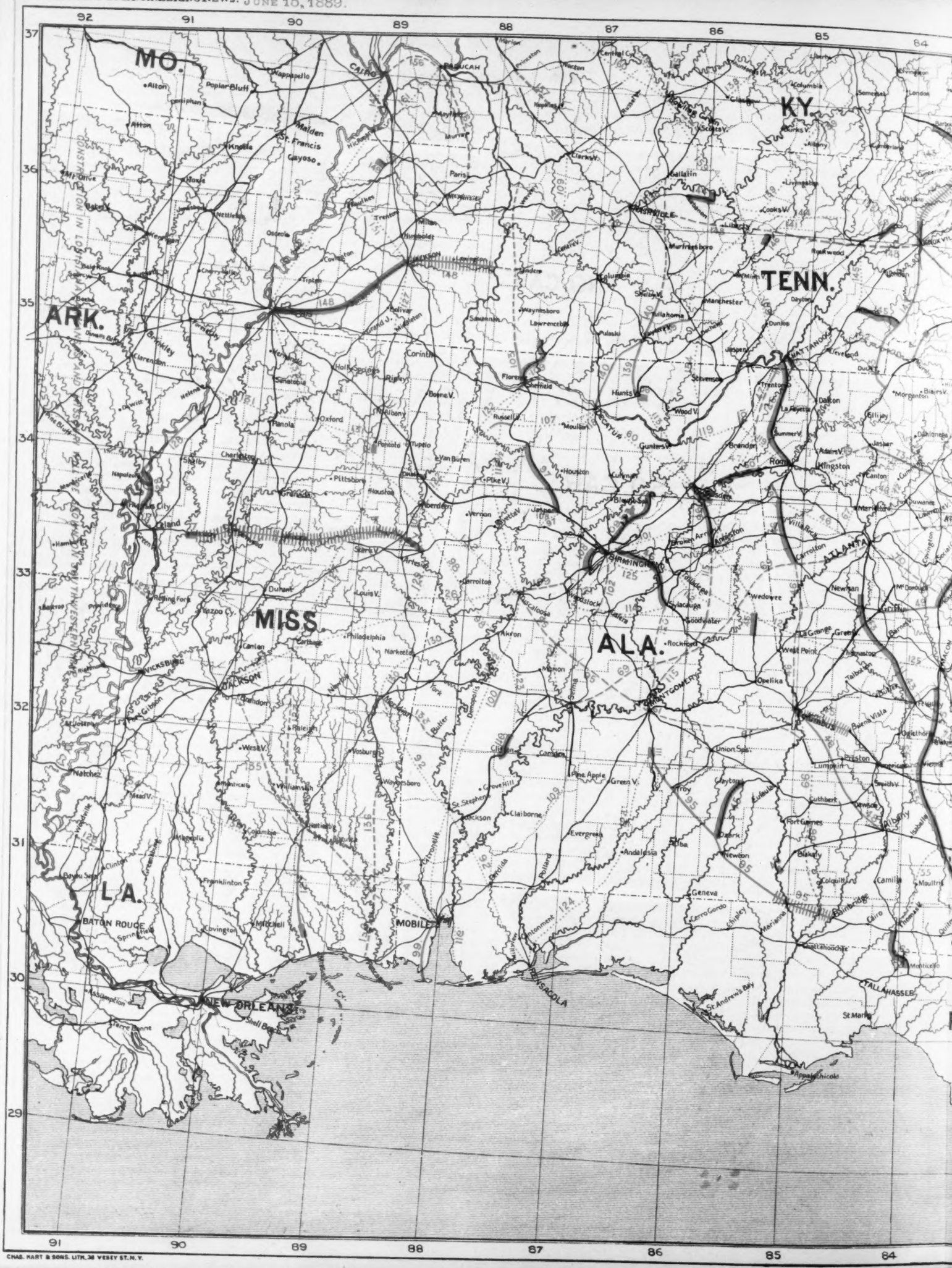
THE fact that no engineer at all was consulted as to the dam rather destroys the force of a moral which the Johnstown disaster would otherwise have for engineers,—that the profession as a whole has a deep interest in protecting itself from the disgrace which the incompetence of charlatans and ignoramuses may at any time throw upon it. Supposing that there had been a so-called "engineer" engaged, who could possibly show a sheepskin conferring that title on him, what means would have remained to the profession as a body to disprove the charge which many newspapers have been quick to bring against engineers—that this disaster proves that they are unable to make any such work really safe? There is but one possible means,—that engineers should themselves assume part of the responsibility of deciding who is and who is not fit for "responsible charge of work"; there is but one effective way by which they can certify to this fact,—by maintaining a national engineering society, to which all reputable engineers are expected to belong, and by impressing on the public the importance of demanding such membership as one of the necessary evidences of fitness for specially responsible work. No absolute assurance that a man is really fit for it can thus be obtained, but the negative assurance that he is not conspicuously unfit will be fairly strong. Engineering being a practical profession, for which no amount of book-learning alone can fit a man, it seems as if the existence of such an organization, which gives in effect a certificate of graduation in the school of experience by admission to membership, must forever remain the only effective channel for insuring at least a certain minimum of knowledge and experience in all engineers who are to be regarded as in good and regular standing.

THE American Society of Civil Engineers is such a national organization, or an excellent beginning toward it. We do not approve of many things in its organization and management, and have not hesitated to say so. We think some considerable changes in both cannot be made too soon. Therefore, we cannot be supposed to be speaking in the interest of that organization as such, for which we care nothing, except as it subserves the interest of the entire profession; and the same is true of the vast majority of its membership. Until last year the Society had this very serious defect in its organization, that any five members who happened to have a grudge against an applicant could absolutely prevent his admission to the Society by secret black-balls. So long as this was so, the Society was not in a position to say that if any engineer did not belong to it, it was his own fault, and, consequently, it could not rationally demand that membership should be made one of the essential evidences of good standing in the profession.

This is so no longer. An amendment passed last year, largely as a result of discussion in this journal, put a stop to secret black-balls. Any engineer in good standing, who has had the requisite experience, can now belong to the Society if he will. All engineers should do so, joining in the junior grades, if they have not as yet the requisite qualifications for the senior grade, and all should use their influence to have membership in the Society a condition precedent to responsible public appointments at least, and so far as may be, to responsible private appointments also. As a large majority of our subscribers are not members of this Society, we may offend some of them by urging this so emphatically; but, if they will think the whole matter over, they will recognize the justice of our position. Reform the Society from within, by all means; in some respects it needs it badly; but do not stand on the outside and growl.

IT may seem somewhat a fine point that experienced and eminent contractors, who may be of much greater average ability than the engineers under whom they serve, should be regarded as unfit for "responsible charge" of work like the reconstruction of the South Forks dam, especially if it be a work outside the line of their prior experience, when no one would think of offering such an objection to a much younger engineer who should assume such responsibility; but consideration will show that there is a substantial reason therefor. The contractor's whole life is spent in the effort to work *cheaply*, and he is free from all direct responsibility for the design and quality of the work. The engineer's anxiety is always that, in design and execution, the work shall be done *well*, with cost a minor consideration. The two are complements and antitheses of each other, and are alike necessary for the successful conduct of public work; but the mental habits of a lifetime cannot be changed in a moment: and hence, while an old engineer generally makes a poor contractor, an old contractor is still more apt to make a poor and dangerous engineer. For those lessons most impress themselves on our minds which directly concern us. The engineer is of necessity continually studying the causes of and remedies for failures of work; he dreads of all things such failures of his own work. He studies with careful attention the failures of others, if he has anything of the engineer about him; and as he grows older invariably grows more cautious, and less inclined to take chances. Naturally, also, from his attention being continually fixed on this side of construction work, he gains a clearer grasp on the causes which lead to failure. The washouts, which mean only more profit in rebuilding to the contractors, mean mortification or even professional ruin to him. These causes tell upon a man's whole nature in the course of years, and hence, while it is to the contractors that we owe most of our advances in cheap construction, it is not without good cause that the public demands that an engineer shall be in charge of every work involving questions of public safety.

THE people in the valley of the Ohio are naturally alarmed at the possible effects upon their domestic water supply of the unrecov-



CHAS. HART & SONS. LITH. 38 VESEY ST. N. Y.

This map will be re-issued, corrected to date, at intervals not exceeding twelve months, and as much oftener as the activity of construction and number of changes may require.

Subscribers and others will please **promptly advise us of all errors or omissions, as soon as detected.** All our Progress Maps are kept continuously up to date, and corrections are constantly making.

50 Miles to 1 Inch.

ENGINEERING NEWS SERIES OF MAPS: No. 15.

SOUTHERN STATES.

TRACK LAID DURING 1888, ...

TRACK LAID SINCE JAN. 1, 1889, ...

LINES UNDER CONTRACT OR CONSTRUCTION, ...

LINES SURVEYED OR UNDER SURVEY, ...

PROJECTS OF SOME PROMISE, ...

Figures refer to the accompanying list.
Lines having the same number are controlled in the same interest.

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(Last preceding issue of this map was on December 3, 1887.)

ered bodies still buried under the wreck at Johnstown and elsewhere, from the dead animals lying uncared-for in the water and on the banks, and from the scouring out of all manner of filth receptacles along the path of the flood. When all this contaminating matter is taken in connection with the present season of the year, there is doubtless ground for grave fears as to the combined result upon the public health in the region affected, and the best of reasons for taking every precaution possible in the use of water and employing the speediest means of removing the more dangerous matter. But as is usual in such cases, the prophet of evil is abroad, and we hear the most dismal recitals of the "sweating sickness" of 1485, of the black plague of London, and even of the plague which removed 624,000 Hebrews in the Wilderness, coupled with the prediction that a similar fate awaits the people of the Allegheny and Ohio valleys, as a consequence of the Johnstown disaster.

BUT it is just as well to look this thing squarely in the face and carefully weigh the conditions and possibilities before jumping at conclusions. Taking the direct path of the flood, we find one town, Blairsville, with a population of about 1,600, taking its supply from the Conemaugh river, and below it is Apollo, with 6,000 inhabitants, deriving water from the Kiskiminitas, a continuation of the Conemaugh. These two towns are certainly in danger. Coming to the Allegheny river, we have Freeport (2,000 inhabitants), Sharpsburg (5,000), Etna (4,000) and Allegheny City with 80,000 inhabitants and Pittsburg with 215,000, all taking water for domestic use from the river. This makes a total population of about 313,000 that is liable to suffer in some degree from poisoned water. But on the other hand it must be remembered that, below the mouth of the Kiskiminitas, the Allegheny is a great river, flowing from the extreme northern boundary of the State and navigable for small steamboats for a distance of 240 miles from its mouth, at Pittsburg. It is a river nearly 300 miles long, with many considerable branches, and flowing rapidly through a semi-mountainous country. This river has been gorged by the same heavy rainfall that brought about the disaster at Johnstown, and for days has been pouring into the Ohio an enormous volume of water, washing away with it and further diluting with the greater volume of the Ohio river and its tributaries, the first and very dangerous scouring of the surface soil of the Conemaugh villages. That danger is then practically past for Pittsburg, Allegheny, and the other towns on the Allegheny river, and it is absurd to figure upon trouble from this cause at Cincinnati, as does a worthy doctor of that city. What remains to be feared is the effect of decaying bodies of man and beast, still in the wreck at the Johnstown bridge, and yet lodged undiscovered along the banks of the stream. No time should be lost in removing these, or the consequences to the survivors there may be as fatal in some respects as the flood. But it needs no outside warning to hasten work in this direction, and there is no doubt that every means possible will be used to remove the dead and protect the living. Briefly stated, the great danger from any epidemic is local in Johnstown and the immediate vicinity; the towns Blairsville and Apollo should for a time cease to use the river water; but as for Pittsburg, Allegheny, and in a lesser degree the other towns, as we pass below, the actual contamination of the river supply will most probably be so infinitesimal as to endanger the public health very little, if any at all. As a river water supply is bad enough at the best, the addition of *any* contaminating matter cannot but make it worse, and hence the usual summer caution in the use of the water in question should be more carefully than ever observed. But beyond the ill-fated Conemaugh region, we do not see the occasion for the great alarm pictured by some of our contemporaries.

OUR map of the scene of the Johnstown disaster in our present and last issue is the first correct one published, so far as we have observed, most of those which have appeared on the alleged authority of the "Geological Survey," etc., having been very erroneous, especially in showing the Conemaugh valley as nearly straight, when it has in fact some decided horse-shoe curves in it. We are indebted for the opportunity of presenting this map to the old established map firm of GEO. W. COLTON & Co., who very kindly unearthed for us, after a long search, an old and (as we have since ascertained on the ground) very accurate county map, published in 1867, and which long since went out of print. The well established reputation of this firm for accuracy in map-making first led us to seek for information among their records, and for our readers and ourselves we again return thanks for their courtesy in this matter and for the well-tested nature of the material furnished. The "Geological Survey of Pennsylvania" has not yet published a map of Cambria Co.

WE present with this issue Map No. 15 of our series, showing the progress of railway construction in all its stages in that portion of the Southern States lying south of the latitude of Richmond and east of the Mississippi river. The activity which our map and statistics show is very considerable. Indeed, at the present time the work of railway extension is more active in the South than in any other section of the country, with the possible exception of the extreme Northwest. Owing to the pressure upon our space we are obliged to delay until next week an editorial review of the various enterprises shown on our map with the statistical summary of the work in progress in each State. The data from which our map and list have been compiled has been furnished us in almost every case by the presidents or chief engineers of the companies; and much pains has been taken to present an accurate and truthful statement of each enterprise. We extend our thanks to the officials who have given us the data in regard to their respective lines and would request that notification be sent us of the further progress or completion of the work.

THE late Gen. JAS. N. MOORHEAD, of whom we said, in our last issue, that he was "stated to have been the engineer in charge of the reconstruction of the South Forks dam," proves to have been not an engineer at all, but a very prominent and successful contractor, and to have been connected, not with the reconstruction of the dam at all, but simply with its original construction, in which the ruins yet remaining bear evidence that he did his part well and faithfully. We take this early opportunity to correct, as prominently as possible, and we hope effectually, an injustice to a man no longer living.

IN direct and pleasing confirmation of late remarks made, pointing out the value of this journal to engineers seeking employment, we have now before us a letter stating that an answer to a "want notice" has enabled our correspondent to connect himself with a well-established engineering firm, with plenty of practice ahead, and further "to marry and settle down in a most desirable city." The writer further adds that "I may thank your journal also for saving me from a possible watery grave, as I left Johnstown only three months ago." While letters of this general character are not infrequent, our share in the immediate present of our correspondent is of too exceptional a nature to allow it to pass without comment. It is not often that any journal can claim to have had a considerable share in settling an individual pleasantly in professional life, enabling him thereby to marry, and finally to have been possibly instrumental in saving his life. We certainly cannot promise as much to every correspondent, but we will always gladly do our share in presenting the chance of an equally good connection, and we do not doubt that our clients themselves can attend to the marrying part.

The South Forks Dam.

Since our last issue, by means of examination and survey of the broken dam, by investigation, and by inquiry of many different persons at Johnstown and Pittsburg, we have obtained all, or nearly all, of the essential technical facts relating to this structure, and have learned of some interesting and important features which have not yet become public, the attention of the daily press having been as yet directed to the consequences of the disaster rather than to its underlying causes. The following information we have directly from unimpeachable sources, except as otherwise noted, but these sources of information we are not in some cases at liberty to state.

The original dam was designed and built, as stated last week, by the late WM. E. MORRIS, Principal Assistant Engineer Pennsylvania State Canals, in charge of Western Division. He was an able and experienced engineer, and the dam, under his supervision, was thoroughly well built by the late GEN. JAS. N. MOORHEAD. It had no central core of masonry as the preliminary estimates indicated, but it was built in horizontal layers, thoroughly watered and rammed, riprapped on both slopes, and provided with an ample spillway through rock, and an arch culvert underneath it, through which ran five 2-ft. cast-iron pipes for discharging the water during the dry season, into the South Fork, from which the water ran down in the river channel to feed the State canal at Johnstown, 14 miles below by the river, which was the head of canal navigation.

The canal, and the dam with it, were abandoned as public structures in 1857-1858.

The first break, in it which occurred in July, 1862, was caused by a defect in the foundations of the culvert, through which the five 2-ft. discharge pipes were carried. This break did comparatively little damage, the reservoir having been only half full, and the discharge having been quite slow, wholly from the bottom, and choked from time to time by fall of material from above. So far as we can determine, it carried out only about half as much material from the dam as the last break, or about 50,000 cu. yds. There is great difficulty in determining with exactness the quantity of material carried out in the first break. Most of those who ought to know say, "150 to 200 ft. wide on top," but then most of the accounts of the last break have called the gap only 200 ft., whereas it is actually more than twice that. No photographs taken after the first break are discoverable, but it is probable that the gap was smaller than the present one, especially on the upper side, where the remarkable benches of old work, still remaining after two break-aways, as shown in our illustrations, testify to the care

and thoroughness with which the original embankment was constructed, and rammed in regular layers.

At the bottom of the old break, also, enough of the material remained to make a little pond about 8 ft. deep above the dam, which remained in this condition, unused, until in May, 1875, the property, consisting of something over 500 acres, was sold to Congressman JOHN REILLY. The lake itself was 400 acres in size, not 700 as has been reported. After holding the property unused till 1879, Mr. REILLY offered it for the sum of **$2,000** to the late Col. B. F. RUFF, an old and successful railroad and tunnel contractor, and the originator of the South Fork Fishing and Hunting Club. Col. RUFF interested two other Pittsburg gentlemen in the project, and stated to them that the dam could be reconstructed for a sum not to exceed $1,500, and that "he would take a contract to do it for $1,700."

On this basis the Club was organized, and for some time these three gentleman were its only members. No one of them is now connected with it. Col. RUFF's idea had been to reconstruct the dam much lower, only 40 ft. high, but it soon appeared that to cut down the rock spillway would cost more than to reconstruct the dam to its original height, and by the time this had been done the total expenditure, as shown by the pay rolls, had been slightly over $10,000, or about 20 cts. per cu. yd. There still remained to be done the riprapping the slopes and other miscellaneous work, as to which our information is less precise, being only that it "may" have cost $7,000, but not more, bringing the total cost up to the very small figures of $17,000, which have been given on other authority in newspaper despatches. This work was all done in the summer of 1880. The original dam was estimated to cost $188,000 and actually cost nearly $240,000.

Col. RUFF engaged as foreman and superintendent for this work a Mr. EDWARD PEARSON, of Pittsburg, a cousin of the present Mayor of Allegheny City. It is a general impression in the vicinity of Johnstown and Pittsburg, among those who know anything about it, that Mr. PEARSON was the "engineer" of the repairs, but this is incorrect. He is not and never has been an engineer, but after 1880 was employed in the local freight department of the Pennsylvania Railroad at Pittsburg, until he formed his present connection, which is with the firm of Haney & Co., general teamsters for the Pennsylvania Railroad freight department. We were also told that Col. RUFF was "the engineer," but this statement also is incorrect. So far as we can ascertain by diligent inquiry, he not only was never an engineer, but he had never been engaged, before this time, even as a contractor on water-works or dam construction. If he was ever so employed at all, it would appear that it must have been to an unimportant extent.

In fact, our information is positive, direct, and unimpeachable that *at no time during the process of rebuilding the dam was* ANY ENGINEER WHATEVER, young or old, good or bad, known or unknown, engaged on or consulted as to the work,—a fact which will be hailed by engineers everywhere with great satisfaction, as relieving them as a body from a heavy burden of suspicion and reproach. The precautions taken against failure were only such as an experienced railroad contractor's knowledge of hydraulic engineering indicated were admissible without further increasing a contemplated investment of $3,700, which had to be increased at best by over $10,000.

Information gathered for us by Mr. T. S. MILLER, M. E., of the Lidgerwood Manufacturing Co., who assisted in our surveys, corresponds with that gathered by us from other reliable sources, that the work of reconstruction was done with the slight care which the preceding facts make probable. The old material, which had caved in, and so lost its compactness, was left untouched; the top of the dam was worked down on to it; the old pipes and culvert, which still remained in somewhat injured condition, were covered over with earth and permanently closed, a double row of hemlock plank sheet piling being driven across the old channel. The water during reconstruction was carried across the dam in a board flume, which was raised from time to time as the work progressed. There was no careful ramming in watered layers, as in the first dam, although some say there was some ramming. There was much leaking during the process, and some tons of hay and straw were filled in. The dam was finally made fairly tight, but there has always been some leakage at the bottom and of late years this has been increasing. The truth as to the exact amount of leakage is very difficult to ascertain. The original crest height of the dam was decreased from one to three feet, and the spillway was shortly after obstructed with gratings to retain fish, and a trestle bridge was built across the opening.

Further details in regard to all these matters are given in connection with our engravings elsewhere. It may be that we are doing the reconstruction injustice, and if so we earnestly trust the facts will be brought out fully in the long, official investigation which is sure to follow. The great difficulty is that the work was done nine years ago, attracted no great attention at the time, and was not observed at all by any experts in such matters of whom we can now find trace, and it is not easy to reconcile discrepancies in the statements of the different casual observers. For example, one man, who ought to know as well as any one now living, assured us that *rock alone* was used in rebuilding the dam, the absurdity of which statement our drawings will at once make evident. The most telling fact to engineers, however, will be the certain one that the dam was rebuilt complete, except the riprapping, for the sum of $10,000, a fact which shows that no great amount of care could have been expended on the work.

Negligence in the mere execution of the earthwork, however, if it existed, is of minor importance, since there is no doubt that it was not a primary cause of the disaster; at worst, it merely aggravated it. The primary causes of the disaster were the lowering of the crest, the dishing or central sag in the crest, the closing of the bottom culvert, and the obstruction of the spillway, all of which are illustrated and more fully described elsewhere.

The changes in the conditions of safety resulting from these last named causes were most important. We still lack definite evidence as to what the original height of the crest was above the bottom of the spillway. If the evidence of Mr. W. J. MCALPINE, confirmed by the Cuba dam, as elsewhere summarized, may be accepted, the original crest was 10 ft. above the bottom of the spillway. There is nothing in the situation on the ground to make this improbable, while much of the less valuable verbal testimony points in the same direction. In any case, the original crest must have been 8 ft. above the spillway. In the reconstructed dam the height of the crest at the ends of the dam was only 7 ft. above the spillway floor, which was further decreased by a sag in the crest to 5½ ft. at the ends of the still remaining bank, and probably to but little more than 4½ ft. in the middle of the portion washed away. That such further sag existed is inherently probable from the evidence of the remains, but it is proved to have existed by the fact that there is a low, tapering mound of earth about 8 ins. high on the still standing crest, which is known to have increased on the part washed away to a bank of considerable height, on which 25 men were at work for hours before the break.

Again, the five 2-ft. pipes under the dam had an area of 15.7 sq. ft. This would only amount to about 3 ins. depth across the spillway, but the discharging capacity under 70 ft. head was at least 564 cu. ft. per second, as much as a weir 72 ft. wide could discharge if 1.8 ft. below the reservoir water levels.

As for the spillway, it was seriously obstructed, as elsewhere more fully shown, (1) by a sill about 2 ins. high; (2) by an iron fish-guard 18 ins. high, composed of half-inch rods 1¼-in. apart between centers, or only ¾-in. in the clear, which is close enough to readily catch leaves and fine brush; (3) by an 8 x 8 stick floating cornerwise, sliding vertically on a rod at each end, and armed with closely driven nails to keep fish from jumping over it; (4) by the posts of the trestle bridge, equivalent to closing about 6 per cent. of the opening; and (5), at the time of the break, by a ragged piece of drift 10 ft. long and 2 ft. in diameter, and some smaller obstructions. These obstructions were placed at the head of the spillway, where it had been enlarged about 20 per cent. in width, apparently with the idea their effect would thus be eliminated; but while it is true that they did not decrease the capacity of the spillway below, if running at a given depth, they did increase the necessary lake level, to give that depth, by an amount which, at the high velocity of nearly 20 ft. per second which then obtained, we should estimate as at least *one foot*. Various engineers whom we have consulted as good authorities on such matters estimate that the obstructions increased the lake level under the given conditions from 6 ins. to 2 ft. Had the bridge and all its obstructing attachments been cut away in time, the disaster might possibly have been averted. There is no evidence discoverable that the water in the spillway below the bridge was at any time over 4 ft. deep, and this appears to have been the maximum possible without running over the crest.

Now, if we assume a 2 per cent. hydraulic grade line in the spillway proper, after the obstructions at the entrance were passed, and compute the comparative discharge for the given cross-section for varying depths by Kutter's formula,* we shall find the following striking contrast in conditions of safety:

With the crest of the dam above bottom of spillway	Velocity, ft. per sec.	Area of water section sq. ft.	Discharge in cu. ft. per sec. from spillway and pipes.
10 ft.	24	840	18,330 + 564
8 ft.	22	655	14,300 + 564
4½ ft.	18	375	6,700 + 0

The first two lines represent (one or the other of them) the conditions which existed in the original dam. The last line represents *the most favorable conditions which can have existed just before the dam broke;* because it hardly seems possible that the center of the dam can have been much if any higher than 4½ ft. above the bottom of the spillway, and *full* credit for this height is given without any deduction for the loss of head by obstructions in the spillway, which we have estimated at 1 ft. If we were to allow for this also, it would bring down the discharge to about 4,700 cu. ft. per second; and we very much question if there was much if any more water than that

* Using the coefficient 0.35.

going through the spillway when water began o run over the crest.

Was there this amount of water to be provided for? The ordinary flood discharge of the stream, according to the original reports, is nearly 2,000 cu. ft. per second. This is expressly described as a "*moderate* estimate." The rainfall appears to have been at least one inch per hour for several hours. To discharge ½-inch per hour from the whole water-shed, an enormous but not unprecedented discharge, would require 9,600 cu. ft. per hour, which the spillway in its original condition would have discharged with ease without aid from the iron pipes under the dam. About that amount, probably, is what had to be taken care of. To raise the whole area of the lake 10 ins. per hour, which is the reported rate before the break, required an accumulation of at least 4,023 cu. ft. per second. Really, it was about 4,500 cu. ft. per second, because of the greater area due to the high water. This, added to our estimate of 4,700 cu. ft. per second of spillway discharge, gives 9,200 cu. ft. per second coming into the lake when the dam broke,—an estimate close enough for all practical purposes to the 9,600 cu. ft. above.

Such is the wretched story of this dam. Doubtless, further and more leisurely investigation will show details which need correction, but in its substance we apprehend that this account will prove correct. We are thankful that no engineer was connected with it or can be held in any manner responsible for its construction; and we may now add, in conclusion, that the same is true in substance of its continued existence. We have investigated carefully the various specific reports which have been made since the disaster, that the dam was periodically or occasionally "inspected" by engineers, but find no evidence that it was even once inspected or approved by any engineer commissioned for that purpose, who, by any stretch of charity, could be regarded as an expert. Inspection by local or junior engineers has from time to time been made, some approving, some disapproving, but not one opinion that we can learn of, in favor of the dam, came from sources which would carry much weight in the profession. Had there been any such, it would unquestionably have been at once published.

The report that certain Pennsylvania Railroad engineers "regularly inspected" the dam is denied by a number of officers who should know, and we are satisfied it is without foundation. Mr. JOHN D. PARKE, Jr., it is true, who was in charge of the efforts to save the dam, is an engineer by education; but he is still a very young man, only a year or two out of college, and did about all that could have been done, except to clear away the bridge and its fish-guard attachments, which obstructed the spillway. A man of great resolution, self-confidence, and self-sacrifice might have diminished the disaster when he saw it was inevitable by cutting the dam at one end, first sending down warning that he was going to do so. This would have greatly decreased the rate of erosion, since there would have been only one side to erode, and that would have been in the more solid old work.

But until the dam had actually broken, there could be no absolute certainty that it would break, and to certainly cause a minor disaster to avoid the chance of a greater one would require no common courage, even if at all justifiable. In this instance the course suggested would probably have saved a third of the property and nine-tenths of the lives, but the disaster would still have been a terrible one, for which probably Mr. PARKE would at this moment be execrated throughout the Conemaugh valley.

The Public Supervision of Dams.

To the best of our knowledge, the State of Rhode Island has the most effective laws regarding the safety of its many dams and reservoirs, and the Commissioner of Dams of that State has done very good work in inspecting and reporting upon their condition. What the full powers of this Commissioner are, we do not now exactly know; but the seeming effect of his work is that those who own and control dams are more than ever careful of their condition and use every reasonable precaution to insure their stability.

The State of Connecticut passed an act in 1878 "To provide for the supervision of reservoirs and dams," but in the light of late events the sufficiency of this law is now being questioned. The act provided that the engineer member of the Board of Railroad Commissioners and one civil engineer in each congressional district should constitute a Board of Civil Engineers, which should have the supervision of all dams and reservoirs existing or to be constructed, the destruction of which might result in danger to life or property. This law compels all builders of new dams to submit their plans and specifications to members of this board, who must examine the ground and approve or disapprove the plans, inspect the dam during construction, and issue a certificate of soundness if all is right on the completion of the work. As far as the new dam is concerned, the safeguards seem sufficient, but when it comes to existing dams, the law is weak. Dams already built are only to be inspected by this board upon application made by citizens who fear damage, and through the executive officers of the city, town, or location affected. But even when this inspection is made, and the dam or reservoir pronounced unsafe, there is no provision compelling repairs. A notice is simply served upon the owners or those in control, requesting them to make the work good under the supervision of one of the board of engineers, and there, apparently, the supervision ends.

Like too many other laws that make a pretence of protecting the public, this Connecticut enactment "providing for the supervision of dams and reservoirs" stops just short of the point where it might be reasonably effective. It is not compulsory; it creates a board without clothing it with the very necessary power to force compliance with its rulings; and, worse than all else, it provides for a reasonable degree of care in the inspection of new construction, but practically leaves the old and really dangerous dams without oversight. But even this law is better than none at all. The States of New York and Pennsylvania, among many others, allow any one to build a dam as he may see fit, with more or less engineering knowledge and experience, or none at all, as in the case of the rebuilders of the South Fork dam.

How this apparent defect in public control of work that may bring disaster to the public had best be remedied is a question that now greatly interests many communities. If new laws are to be made, everything will depend upon the manner in which they are enforced; and it is here that the engineer will come in and the method of his appointment. This engineer should be selected for his special fitness, and to insure the separation of his office from politics it would seem better that he be appointed by the Governor of the State upon the endorsement of the Board of Direction of the American Society of Civil Engineers; for the reason that this professional body has better means of judging of the fitness of the candidate than are at the command of any individual, and this endorsement would be the nearest practicable approach to a guarantee to the public that the duties of the office would be intelligently performed. As this officer should have ample power to compel compliance with his recommendations, this public belief that the man understood his business thoroughly, and would enforce only necessary precautions, would go far towards doing away with the friction that otherwise might result from the attempted enforcement of the views of an official who would merely be regarded as occupying a public "place."

The tenure of office should be long, perhaps not less than ten years, and it might be well to provide a reasonable pension for the officer who had faithfully devoted the best part of his professional life to guarding the life and property of the citizens of the State. He should have sufficient assistance to gather and keep complete records of every dam and reservoir in the State, together with every condition of detail of original construction, maintenance, watershed, purpose, possibilities in case of destruction, etc. With such a provision in force, there might be a decrease in the number of pleasure resorts for hunters and fishermen, but the general public would be better off.

And last and most important of all, this supervising engineer of dams should have full power over all dams, new and old, as far as their design and stability are concerned, and the law should enable him to enforce his recommendations in all cases. With the fitness for office guaranteed in the manner proposed, there would be little danger of any improper use of power or of injustice to the individual. And even in a case where it seemed best to be on the safe side and guard against seemingly remote dangers, it is far better that an individual or corporation should devote a certain sum of money to insurance than that the life of a single member of a threatened community should be sacrificed.

No dam need be a menace to life and property, and it will cease to be such in proportion to the excellence of its original design and the care expended in maintaining it in perfect condition. Too much experience and care cannot, therefore, be thus expended; and yet there is probably no class of engineering works, regarding the construction of which there is usually so little public concern. Every one thinks he and his neighbor can build a dam, and they may build one that will be safe for a long term of years; and in the case of low dams, the very ignorance of all rules controlling proportions very generally causes an error on the safe side. But when this same public indifference permits the construction of a high dam, impounding a great volume of water, under these same conditions of ignorance of principles and carelessness of possible consequences, some one must suffer, as was the case lately at Johnstown. It is because of this indifference that the State should exercise its parental powers over the people, and with a strong hand compel them to take care of themselves by enforcing such supervision over public and private construction as is here outlined. After all, the comparatively small sum that this official inspection costs is an infinitesimal insurance fee when contrasted with the possible cost of a disaster such as visited the valley of the Conemaugh. And if economy is a consideration in this matter, one thoroughly competent and well-tried engineer might be put in charge of all the dams and reservoirs in New England, for example.

The severe lesson taught at Johnstown should not be lost upon us, nor our interest in

the general safety of all dams be allowed to die away with the day's excitement. The South Forks dam was only an unusually bad example of a dangerous class of structures, and no time should be lost in getting at the innermost facts concerning the condition of each and every one of them, and eliminating those that are dangerous. The only treatment proper for a bad dam is to uproot it to its foundations, and replace it with a good and substantial structure, if there must be a dam at that point.

Brick Street Pavements.

The following matter is condensed from a paper by Mr. EDGAR RYAN, published in the Michigan Engineers' Annual:

Bloomington, Ill., seems to have been the first American town to have experimented with brick for roadway pavement, and a courtyard so paved, fifteen years ago, as a test under considerable traffic, is still in fair condition after scarcely any repairs.

Clay, to make good paving brick, should be able, without fusing, to withstand a sufficient degree of heat, and for a time long enough, to render the brick hard and impervious to water. Fluxing agents are also necessary to render the brick homogeneous and tenacious. Among the clays that have been used more or less successfully for paving material, and the firms manufacturing them, may be mentioned the following:

The clay from which the Hayden Paving Block is manufactured is a "Mingo" fire-clay, from Haydenville, Ohio. This clay has nearly the compactness and density of fine-grained sandstone, and yet is semi-plastic. Nitro-glycerine is used in mining it, but it is easily reduced to powder in the dry-pan under heavy rolls, and when ground it mixes easily, works smoothly, and resists great heat. The paving block is burned for ten days in a temperature of 2,000° Fahr. This block is square in plan, 5¾ ins. on a side, and 4¾ ins. deep; it is hollow below, to facilitate burning and to save material, and has a flat upper surface broken by indentations to provide a firmer foothold for horses. These indentations, however, are of little value, as they are soon obliterated under heavy travel. The blocks are salt-glazed, and the outer top edges are slightly beveled to admit of a filling of sand, pitch, or other material. One thousand blocks will lay 29 sq. yds. at 50 cts. per hundred, or $1.92 per sq. yd. A block weighs about 9½ lbs. or 360 lbs. per sq. yd. An analysis of this clay was made by Prof. E. M. REED, and it compares with the famous Stourbridge clay of England as follows:

	Mingo Fire-Clay. per cent.	*Stourbridge Fire-Clay.* per cent.
Silica	72.24	73.82
Alumina	16.87	15.88
Iron	0.16	2.95
Lime	9.50	trace
Magnesia	trace	trace
Alkali	1.09	0.90
Water	5.44	6.45
Total	100.00	100.00

The paving brick clay of Virden, Ill., is found in a bed 25 ft. thick, just below a stratum of slate and 275 ft. below the surface of the ground. It is compact, with a distinct cylindrical cleavage, of a light steel-gray color, and when first mined emits the characteristic odor of slate. It is blasted, but can be reduced to an extremely fine powder, free from grit. It has a specific gravity of 2.5595. A piece of this clay can be kept at a white heat in a hard coal fire for twelve hours and not disintegrate.

The clays used at Bloomington, Ill., are surface clays of three varieties, *A* is a yellow, aluminous clay, very fine and plastic, and is found 3 ft. below the surface in a bed 12 ft. thick. It is simply tempered in a pug-mill and burns to a grayish-red color. *B* is a hard-pan clay lying just beneath *A*. It is very troublesome to reduce to an impalpable powder. When dug, and left "to weather" for one winter, it gives good results. It burns from pink to cream in color. *C* is a blue clay from under *B*. It is fine, firm, very tenacious, and burns to a chalk white. In some respects it is similar to the light-blue fire clay at Empire, Ohio.

The experience of the best makers of paving brick leads them to conclude that fineness of grain is most essential to good results, but the clay must first be reduced in a dry state to an impalpable powder. Clay of the desired composition, but neither dry nor fine, may be calcined and then finely ground. This grinding is very essential in reducing the amount of heat required to vitrify it to a homogenous mass, and the finer it is ground the stronger and harder will be the brick and the better it will stand abrasion. We quote other portions of this paper as follows:

At Nashville, Tenn., are used creosoted or bitumenized bricks, prepared by saturating common kiln bricks of medium hardness, under a high degree of heat, with liquid pitch, obtained by distilling coal-tar. These bricks have been laid about four years, on a good foundation of rolled macadam, bedded on edge in 1¼ ins. of sand, and rammed tight. They have been subjected to a considerable amount of traffic, and show very little if any wear. The cost was $1.80 per sq. yd. for brick and laying on finished foundation.

At Youngstown, O., fire-brick on cement concrete base and sand with pitch in joints, cost for all, $1.73 per sq. yd. Their best bricks came from Empire, O., and New Brighton, Pa.

At Allegheny City, Pa., fire-clay bricks from the West Virginia Fire-Brick Co., have been laid in two layers on rammed and rolled gravel and sand, at a cost of $1.95 per sq. yd., exclusive of grading. The pavement, in use three years, is stated to be very smooth, easily cleaned, and of a handsome appearance.

At Bloomington, Ill., some 2½ miles of brick paved streets have been laid with bricks of home manufacture *A*, *B*, and *C*. The sample herewith was under traffic there 12 years. The corner and edge of one end, and also the large scale on the upper edge of the same side, were broken off with a pick in removing the specimen from the pavement. It does not appear to have lost appreciably in width, although the majority did not present so favorable an appearance, having generally lost the upper edges and corners. Such pavements, however, are not noticeably rough in driving over them, and afford good foothold for horses. The brick pavements in Bloomington, generally speaking, are in good condition, and are being constantly extended. They have stone blocks, Nicholson and macadam pavements also, and prefer brick on the score of cost, durability, lack of noise, home production, ease of cleaning, and repairs. The entire pavement, two layers of brick, including *all materials*, grading, and stone curbs, cost $2.00 per sq. yd. with laborers at $1.60 per day, teams $3.25, and sand 80 cts. to 90 cts. per cu. yd. delivered.

Jacksonville, Ill., has laid over 3 miles of pavement with Virden brick. Some down for five years is now in good condition. One piece, of one-half mile, 2 layers, cost, including everything, engineer's services and all, $1.92 per sq. yd. Sand was filled into the joints in place of pitch.

Cincinnati had a pavement on rolled sand. A failure.

Peoria, Ill., paved 2 blocks in 1886, and 5 blocks in 1887, with Ottawa paving brick, and Chicago used the same brick 3 or 4 years ago on 63d St. car tracks.

The intersection of Washington and Dearborn Sts., Chicago, was paved with Hayden paving blocks in 1886. In March, 1888, it was found to have succumbed to the very heavy traffic, and crushed. Galesburg, Decatur, Champaign, and Springfield, Ill., have laid more or less brick pavement within five years, the major part of which has given satisfaction. New Orleans and Wheeling, Va., Steubenville, O., Camden, N. J., and other places, have laid experimental sections. The disadvantages of brick pavement arise from lack of uniformity in the material, and the liability of incorporating in the pavement brick of too soft and porous structure, which crumbles the first winter under the action of frost. When laid on a solid foundation, the advantages are, cheapness, smoothness, cleanliness, freedom from noise, and sanitary excellence as non-absorbent. See table above. Taking all things into consideration, it is superior to macadam, wood, and, for a maximum traffic of three tons, superior to granite.

Repairs on a Wrought-Iron Pipe Main.*

I have the pleasure of presenting to this Association an account of a novel and interesting method of repairing a break in a wrought-iron pipe. The details were given me by Mr. JOHN WHITELAW, engineer and superintendent of the Cleveland Water-Works, and are read to this Society with his permission.

A leak of considerable size was suspected in a 10-in. wrought-iron main in the bed of the Cuyahoga river, Cleveland, and upon proving its existence in the usual manner of testing, its precise location was ascertained by a diver, who noticed the disturbance of the sand in the bed of the river, due to the jet from the pipe.

Instead of uncovering the pipe, which was 6 ft. beneath the bed of the river, in the usual manner by a dredge, a tug-boat was anchored so as to bring the propeller over and ahead of the spot desired to be uncovered. As the depth of the water did not exceed 12 ft., the revolutions of the propeller produced sufficient wash to uncover the pipe, making it perfectly accessible for repairs. The break was found to be about 3 ins. by 4 ins., irregular in shape, on the upper side of the pipe, taking in a portion of a riveted joint, both longitudinal and circumferential, presenting a very uneven surface upon which to make a patch. The leak was doubtless caused by a strain in the joint which opened sufficiently to make a small jet, that finally, with the sand, cut the hole to the size stated.

The diver obtained an impression in a plastic material of the break and the surrounding surfaces, from which a mould was made, and from the mould, in turn, a casting in lead was obtained, which fitted exactly all the irregularities due to the rivets and seams of the pipe. The lead casting was backed by suitable forgings, and the whole thing secured in place by hook bolts, similar to those used to secure the cover on a man-hole of a boiler. With a little tamping the patch was completed, and the pipe stood the pressure test perfectly. The work, including the necessary forgings and dredging, was all completed in about eighteen working hours.

The method of repairing a break of this kind just described, is believed to be novel, is certainly ingenious, and would seem to be an available and practicable method of making repairs on all water pipes, either wrought or cast iron, under water. Similar patches have been made, using a thick, soft rubber packing secured in place by a band around the pipe. It is thought that the lead piece, secured in place by the hook bolts, is a more permanent and durable method, while the means used for dredging were very economical and expeditious as well as effective.

I have since learned that this plan of dredging, somewhat novel in this vicinity, is a very common thing in Cleveland; and when a schooner gets ashore, instead of trying to take the schooner from the bank, they take the bank from under the schooner, which they do by having a tug-boat near by and washing the sand away.

*By J. A. TILDEN, C. E., Boston, Mass., in Journal of New England Water-Works Association.

WHY SYRACUSE SHOULD HAVE AND OWN PURE WATER was the subject of a late Sunday evening sermon by a minister of that city. Successive points well maintained were: that Syracuse needs better water, more water, and that there is money in furnishing water to the city. He stated that there are 1,400 wells in the city, of which the State Board of Health says about 1,000 are unfit for use. The speaker was in favor of city ownership, and cited figures to show that this would be greatly for the city's interest, and especially for so large a city as Syracuse. He said that of 443 towns and cities having a water supply, only 38 had expenses to exceed the receipts, and that of all the cities in the United States with a population of over 50,000, only 9 are supplied by private companies.

The fact that a Sunday sermon was preached on this subject illustrates the intense struggle over the water-works question in Syracuse. For a city with an estimated population of 80,000, the matter of a pure and plentiful water supply, and its control, is certainly of sufficient importance to warrant study by and instruction to the people from the clergy; and this is all the more true because of the general ignorance and oftentimes indifference of the majority of our city populations on all sanitary and municipal matters. Any earnest and honest efforts to remedy such deplorable ignorance and indifference should be heartily welcomed and encouraged.

THE "ZONE" SYSTEM FOR RAILWAY FARES is to be put into operation on the Hungarian State railways by the Minister of Finance, M. WECKERLE. The scheme is outlined as follows:

Throughout the Hungarian system of nearly 5,200 kilometres, including the international lines, it is intended to introduce a scale of fares on the basis of equal "zones," instead of reckoning from station to station. At first it was proposed to have only 3

of these zones, but it has now been decided to have 14, extending from Buda-Pesth to the extreme limit of the system. The third-class fare within the first zone will be only 9 kreuzers, or 4 cts., and, although the fare to the other zones is progressive, the longest possible journey will cost only 8 florins first class, 6 florins second class, and 4 florins third class for traveling over 500 kilomètres. This scale is about one-fifth of the present rate. To make up for the reduction, free passes and return, or season tickets, will no longer be issued, and the Minister reckons upon effecting a considerable economy in the working expenses, and using the whole of the rolling stock, half of which is generally lying idle.

The idea of a zone tariff on railways was first formulated by the German statistician ADOLPH ENGEL, but has never been tested in practice. The capital invested in the Hungarian state railways is over 400,000,000 florins, and last year the gross receipts amounted to 40,000,000 florins, the working expenses being 54 1-2 per cent. These figures give an idea of the enormous risk attending the experiment.

A "WONDERFUL" FEAT OF LEVELING. — Good, every-day instrumental work is rare in some parts of Maine, according to the following extract from the Portland *Press*:

A wonderful piece of civil engineering was recently made at West Gray by Mr. G. D. WEEKS, of Gorham. He started at Mountain View House, and ran round a circuit of over four miles taking the levels, and when he got round to the starting point he made almost a perfect connection, the error being less than an inch. He was obliged to make over two hundred observations. The work took five days of hard labor.

PERSONAL.

Mr. J. D. SCHUYLER, C. E., has been appointed a member of the Board of Public Works at San Diego, Cal.

Mr. F. BROUGHTON, late General Manager of the Great Western Railway of Canada, died recently.

Mr. EDWARD CRANE, Vice-President of the New Jersey Construction Co., died in New York, June 3.

Mr. TIMOTHY KELLY has been elected Water Commissioner at Norwich, Conn.

Mr. T. P. BROWN, President and General Manager of the Toledo, Columbus & Southern Ry., has retired.

Mr. J. W. RINGROSE, has been elected Chairman, and Mr. D. A. HARRIS, Superintendent, of the New Board of Water Commissioners at New Britain, Conn.

Mr. J. L. LUDLOW, C. E., of Winston, N. C., has been engaged as engineer on the construction of the sewerage system at Raleigh, N. C.

Mr. WILLIAM N. BIDDLE, of Cleveland, has been elected Treasurer of the Cumberland Valley Ry., vice Gen. E. M. BIDDLE, resigned.

Mr. J. W. TERRY has been appointed Auditor of the Ohio Valley Road, with headquarters at Evansville, Ind.

Mr. W. P. HARRIS having resigned, Mr. J. P. O'BRIEN has been appointed Superintendent of the St. Joseph Terminal Railroad Co., with headquarters at St. Joseph, Mo.

Mr. W. H. NEWMAN, Third Vice-President of the Missouri Pacific Ry., has resigned, and the office has been abolished. Mr. GEO. C. SMITH has been appointed assistant to Mr. S. H. H. CLARK, First Vice-President and General Manager.

Mr. G. J. FORREST, President of the Wheeling & Lake Erie Ry. Co., died in New York recently. Mr. FORREST had been connected with the Wheeling & Lake Erie from its earliest inception, having been one of the original directors. He has been president of the company for the last 6 years.

Mr. A. W. DUNNING, formerly of the Louisville & Nashville, has assumed the duties of Auditor and Treasurer of the Cleveland, Akron & Columbus.

Mr. J. E. MCNALLY has been appointed Contracting Agent for the Cleveland & Canton, with office at the general freight office at Cleveland, O.

Mr. CHARLES C. BREED, Chief Engineer Three Forks Investment Co., Beattyville, Ky., was married to Miss JENNIE PRYSE, of the same place, on June 5.

Mr. BURTON, Division Superintendent of the Mexican Central, has resigned, and it is reported that he will take a position under Mr. D. MACKENZIE, late General Superintendent of the Central, now building a line between Salt Lake City and Cheyenne.

Mr. J. A. WILLIAMSON has been elected President of the Atlantic & Pacific road, Mr. H. C. NUTT retiring on account of ill health, after holding the position for 8 years.

CORRESPONDENCE.

The "Canals" on Mars.

BRANTFORD, CANADA, June 1, 1889.

TO THE EDITOR OF ENGINEERING NEWS:—

I have read the article entitled "The Canals on the Planet Mars," in your issue of the 18th ult. As an astronomer I cannot allow the article to pass unnoticed as it contains one or two assertions which are apt to mislead or leave wrong impressions on those not acquainted with the real facts of the case. In the first place, astronomers are not yet sure that the markings seen by SCHIAPARELLI, PERROTIN, TERBY, and others, exist on the planet at all. With hardly an exception the published drawings of this planet represent the "canals" as *straight lines in whatever part of the disc they may be situated*. I need hardly say that straight canals if they really exist on the surface of the planet, would appear strongly curved when near the limb. For this and other reasons, astronomers look with considerable suspicion on the conclusions of the above-named observers. As subjective phenomena, the markings depicted by the astronomers named have undoubtedly been seen. The late Mr. PROCTOR suggested that they are phenomena of diffraction, and therefore "optical *products*."

With regard to the width of the markings, the writer of the article under discussion believes astronomers have not yet correctly measured it. His explanation of the matter, however, sets all optical laws at defiance. As a matter of fact, if the surfaces of the "canal" acted as mirrors, they would be seen as *bright* lines and *reduced* in width.

Sincerely yours,
T. S. H. SHEERMEN.

[The points of our correspondent seem well taken. We published the paper as to astronomical-engineering curiosity on the authority of the observers named.—ED. ENG. NEWS.]

Finding the Center of Population.

DUBUQUE, IA., June 8, 1889.

TO THE EDITOR OF ENGINEERING NEWS:—

The question of the most advantageous location for a large public building in this city having come up lately, the problem of finding the center of population is naturally involved. Aside from being a matter of some moment to ourselves, we think it would be of interest to many of your readers to know the various practical methods used in its solution; as for instance in finding the center of population of the United States.

Very truly yours, T. *and* P.

[The only exact method of finding the center of population, of which we have any knowledge, is by the concentration of the population in the center of gravity of any section of a State or country, and a somewhat tedious series of trials by the theory of moments, with lever arms extending to assumed centers of population. A rougher method, but one exact enough for many purposes, is to paste on a thin section of board or metal a map of the region in question. Divide this area into counties, townships, wards, or any other division, and find the center of gravity of each area. Then insert a pin at this center and load the pin with weights representing the known or assumed population of that section. When the total population is thus distributed, balance the plate by trial until its center of equilibrium is found, and you will have the center of population. Of course the plate must be cut to the exact outline of the territory in question, and it should be so thin that thickness of the plate would not be an important factor in comparison with the weight representing the most thinly settled district. Or the thickness of the plate may be made to represent an evenly distributed population and the added weights only the surplus per section.—ED. ENG. NEWS.]

The First Break in the South Fork Dam.

Philadelphia & Erie R. R. Co.
PHILADELPHIA, Pa., June 10, 1889.

TO THE EDITOR OF ENGINEERING NEWS:—

I have read with much interest the article relative to the Johnstown disaster published in your journal of the 8th inst., and as you purpose continuing the subject in your next issue, I beg leave to communicate a few facts which may be of interest, and aid in making your account of this most lamentable occurrence more complete.

In July, 1862, a break occurred in the reservoir dam at the South Fork of the Conemaugh, which washed away a portion of the embankment of the Pennsylvania Railroad at the eastern end of the bridge over South Fork, causing a suspension of travel on the railroad for nearly a day. Being at that time Chief Engineer of the Pennsylvania Railroad, with headquarters at Altoona, I was promptly notified of the accident, and immediately repaired to the spot, remaining there until the one track was in condition for trains to pass.

The late Mr. THOS. T. WIESMAN, who was at that time Chief Engineer of the Pennsylvania canal, in his annual report to the Penna. Railroad Co., dated Jan. 1, 1863, stated as follows, viz.: "The Western Reservoir dam gave way in July last from a defect in the foundation of culvert. It is not proposed to repair this work, as an early abandonment of the upper western division is in contemplation."

My own recollection is, that immediately after the breakage, the reservoir was drained, and no water allowed to accumulate there, nor any repairs made, as long as it remained in possession of the Pennsylvania R. R. company.

Mr. WIESMAN in his annual report of January, 1864, states that "The upper western division, extending from Johnstown to Blairsville, was abandoned as a navigable canal on May 1 last, since which time it has not been kept open."

In May, 1875, the property, consisting of about 500 acres of land including the site of the reservoir, was sold to Mr. JOHN REILLY, from whom it subsequently passed into the possession of the Fishing Club.

Yours respectfully,
W. HASELL WILSON.

The Memphis System of Sewerage.

NEWPORT, R. I., May 29, 1889.

TO THE EDITOR OF ENGINEERING NEWS:—

In your editorial discussion of my communication of May 18, I think you wrote under several misapprehensions.

I have never made a claim to have been the first to suggest the complete exclusion of rainwater from sewers,—only to have been the first to carry the suggestion into successful practice.

I have never claimed that I was the first to suggest or the first to use "flush tanks at all dead ends of systems." I believe I was the first to suggest, and I am sure I was the first to use, *automatic* flush tanks in this connection.

If you will read "Bailey Denton" more carefully, you will see that he recommends Field's tank only for the flushing of house drains, and that the context shows him to have had in mind some such flushing as would be effected by the discharge of two gallons of water at each use of water closets in the house. It is only the first part of your quotation that relates to sewers, and in this connection he makes no reference whatever to Field's flush-tank nor to any other *automatic* tank, though he describes and illustrates many devices for hand-flushing. The form of Field's tank that he shows in the chapter on "The Dwelling," probably the only form existing when he wrote, is not suitable for sewer flushing. The sewer flush tank is a later development.

I think you have not shown "that both of these features of rainwater exclusions and automatic flushing" are not original with me.

The letters called out from engineers by my "list of towns" show that in my list of forty towns in which my system was at work, I erroneously include Green Island, N. Y. (Combined System), Fort Worth, Tex. (should have been Fort Smith), and Wichita, Kan., about which doubts have arisen. There are more than three other towns that I did not name. Otherwise my statement is correct.

In support of your remark that "some of the towns of which the statement is true have reason to regret that it is so" you adduce only the case of Memphis, Omaha, and Stamford.

If the "regret" will always take a form so gratifying to me as that which is felt by the citizens of Memphis I shall be rejoiced. Concerning the "case of Omaha, Neb., in 1882" *et infra*, I quote the following from the mayor's annual message of 1886:

"The health of the city depends in a great measure upon its supply of water and its system of sewerage. It is gratifying to know that our city is free from the odious gases and odors that in most other cities are emitted from sewers at every corner of their streets. According to the report of the sewer inspector there was but $2,285.00 expended for salaries and in keeping our system in good working condition. This is certainly a very small sum. There can be no doubt that the Waring system of sewerage is, for sanitary purposes, the best ever devised. It is not intended for storm-water or waste-water from elevators, and in the business portion of the city, other means will have to be provided for the overflow from the latter. One hundred thousand dollars in bonds have been voted for sewerage purposes and I would advise that the Waring system be extended as fast as possible; it is the cheapest system extant."

In every town in which new public works are being carried out, there is aroused, generally for political purposes, a faction in opposition to the improvement. This was especially the case in Stamford. At the Freemen's

meeting in April, a committee of investigation was appointed with an appropriation for the employment of an expert engineer. The committee employed JOHN BOGART, Esq., State Engineer of New York, and Secretary of the American Society of Civil Engineers, and the whole system of sewerage received as thorough an overhauling as it was possible to give it, under the sharp inspection of the chairman of the committee, who had always been a leader of the opposing faction. This committee is to report at a meeting of the Freemen June 3. I beg that you will copy that report, and I shall be entirely satisfied if you approve or condemn "Waring's System" in accordance with its conclusions.

The Buffalo trunk sewer to which you refer is hardly pertinent to this discussion. However, I am very glad of an opportunity to meet newspaper criticism of this work. The city engineer's estimate of the cost of carrying out my plan was $764,370. The same officer's estimate, by the same unit, of the cost of the plan recommended by Messrs. Chesbrough, Shedd (not McAlpine) & Smith was $1,406,782. The actual cost of the present sewer, including right of way and all incidentals, was $1,035,623.88. Even supposing the Chesbrough sewer to have cost no more for quicksand difficulties than mine did, it would have cost, if constructed under the same conditions, $1,906,662. The mayor's secretary seems to have assumed that the purpose of the sewer was only to purify the Hamburg canal. Its fundamental purpose was to keep sewage out of the Erie canal, to prevent legal action on the part of the State of New York and the cities of Tonawanda and Lockport. The mayor says in his last annual message: "A system of trunk sewers has been constructed which, while they have not abated the nuisance in the Hamburg canal as the main sewer was expected to do, are monuments of excellent workmanship, reflecting great credit upon the commission, and entitle them to the thanks of the citizens of Buffalo in whose interests they have labored so long and faithfully."

Concerning the secretary's statement about the Hamburg canal, I have a certificate from the commissioners as follows:

"The undersigned, who were members of the Board of Sewer Commissioners . . . when the trunk sewer was constructed under the supervision of GEORGE E. WARING, Jr., and upon plans made by him, have pleasure in saying that the work was most admirably done, and that the sewer works perfectly, and that we have every confidence in Col. WARING's ability and capacity. This sewer was constructed under an act of the Legislature as an intercepting sewer to receive the sewage of a large part of the city which had before emptied into the Hamburg and the Erie canals. The result has been accomplished perfectly, but as a portion of the city below the sewer still sewers into the Hamburg canal, and as Mr. WARING's plan of diverting that sewage into the trunk sewer has never been carried out by the city, the canal is still filthy." GEO. E. WARING, Jr.

NEWPORT, R. I., May 29, 1889.

[We must dispute the plural in "misapprehensions." Col. WARING, in his letter published May 25, distinctly says that the "important differences" between his system and the English Separate System "are only these: *a*. The complete exclusion of rainwater; and, *b*, the automatic flushing of all the dead ends of a system." As he now denies originality in *a*, and only claims its successful practice, the apparent difference narrows down to *b*. As to this latter claim, Col. WARING again undoubtedly deserves credit for first putting into practice on a large scale the *automatic* flushing of dead ends of a sewerage system, but as to his first suggesting or even using automatic flushing we are not so clear. English engineers certainly recognized and appreciated the value of such methods of flushing, and if they left its wider application to Col. WARING, it was mainly because English economy in the matter of a water supply made any connection between flush tanks and a water distribution system practically prohibitory. Consequently we must yet differ with Col. WARING when he says further in his letter of the 25th, that "the real issue is confined to the benefits to be derived from these two modifications, *both of which are undeniably original with me*." (Italics ours, ED.) The fact that the Field's flush-tank in its present form is a "later development" in England and not in America would also seem to indicate that Englishmen appreciated the true value of the chief mechanical feature in Col. WARING's system of sewerage, and about which feature his whole system revolves. As to the remaining portion of the present letter we can only say that, while a mayor may be an excellent executive officer, and a sewer commissioner a citizen above reproach, we do not usually rely upon their judgment in engineering matters, especially when this judgment runs counter to the opinion of engineers.

BOOK REVIEWS.

Life of CHARLES BLACKER VIGNOLES, F. R. S., F. R. A. S., M. R. I. A., etc., Soldier and Civil Engineer, formerly Lieutenant in H. M. 1st Royals, Past President of Institution of Civil Engineers. "A Reminiscence of Early Railway Life." By his son, OLINTHUS J. VIGNOLES, M. A., Assistant Minister of St. Peter's Church, Vere street, London. Longmans, Green & Co., London and New York, publishers, 1889. Price, $5.

This work, while dealing perhaps too fully with the domestic life of its subject, is a fitting and long-delayed tribute to an engineer who was a contemporary of STEPHENSON, BRUNEL, two RENNIES and those other shining lights of the engineering profession who founded our railway age. VIGNOLES was a soldier for a time, and saw some active service in Holland and America, especially as a military engineer. It may not be known to the majority of our readers that his private professional practice was commenced in Charleston, S. C., in 1817, and that he remained in the United States until 1823, having in that time occupied the positions of assistant to the State Engineer of South Carolina and town surveyor of St. Augustine, Fla. In the last year of his residence here he also published "Observations on the Floridas," accompanied by an excellent map of that region.

Returning to England, he was from 1825 to February, 1827, principal resident engineer on the Liverpool & Manchester Railway under the two RENNIES and until STEPHENSON succeeded these men as the engineering head of that famous road. From this time forward VIGNOLES was more or less identified with nearly every railway scheme in England until about 1845. His more famous works were the projection of the Midland railway system, the Kieff bridge over the Dneiper, and a three-mile tunnel through the Cantabrian Pyrenees, with the difficult engineering of the Bilboa & Tudela railway in Spain.

Referring to the familar T-rail, which is still called the Vignoles rail in England, our author says that the form was invented by the subject of this sketch, apparently about 1836, with the object of doing away with the stone blocks which were then pounding the rails to pieces on the English roads. VIGNOLES wished to substitute "longitudinal timbers," and in his report to the directors of the Midland Counties railway he suggested a rolled T-rail weighing 50 lbs. to the yard, as simpler and less expensive than the form then in use. But the sketch given of the early form of the Vignoles rail shows a section with a very thick base, apparently about 6 ins. wide, scarcely any stem, and a narrow, low head. The rail approaches nearer to the form of our "center-bearing" street-car rail than to anything now in use. The longitudinal timber proposed was about 5x10 ins.

The fault we would find with this biography is that it is written by his son, who was not an engineer. As a natural consequence, the great bulk of the work is taken up with family details, that were doubtless interesting to the author, but are not so much so to the general public. The important engineering services of VIGNOLES are only lightly touched upon, and his more important works and the busy end of his professional life are crowded into the final third of the volume. But it is a very readable book, and the very minuteness of some of the data given may be of great use in throwing light on hitherto obscure passages in the early history of railway engineering.

PUBLICATIONS RECEIVED.

—*The Journal of the Franklin Institute.*—June, 1889. Published by the Institute, Philadelphia, Pa.

This number contains among other matter the report of the Committee on Science and the Arts on Atkinson's Gas Engine, "A Contribution to Meteorology," "The Diffraction of Sound," etc.

—*Intermittent Flush Tanks.*—Illustrated pamphlet published by the Flush-Tank Co., of Chicago, Ill.

It gives notes on the use of such tanks and contains illustrations and descriptions of the Rhoads-Williams, Field-Waring, Cuntz, Vibbard and other form of tanks.

—*Catalogue of the Buffalo Forge Co.*, of Buffalo, N. Y.

Sectional catalogue of hot blast apparatus, steam fans and disc wheels for warming, cooling, ventilating, and drying; it is devoted to the company's line of power blowers and ventilating fans, used with the method of hot blast drying, and the system of warming and ventilating factories and large buildings by a mechanical circulation of warm air, known as the indirect radiation or hot blast system. Prices and dimensions are given. Illustrations are given showing the fans and other plant, and also the application of the system to large buildings, furnaces, etc. There is also a general description of the system, and some useful tables of the amount of air removed by exhaust wheels of different sizes and at different speeds, diameter, weight, and capacity of pipes, etc.

—*Annual Report of the Commissioner of Railroads and Telegraphs of Ohio.* 1887. W. S. CAPPELLER, *Commissioner*. 6¾ x 9¾ ins., cloth bound, 1,192 pp. Published by the State.

—*Journal of the New England Water-Works Association.* Quarterly number, June, 1889. Published by the editor, New London, Conn. Price 75 cts.

This number contains reports of meetings, papers on "The Quincy Dam," by L. A. TAYLOR, and "The Relation of Great Ponds to Water Supplies for Cities and Towns," by J. F. JACKSON, and an abstract from a report by N. H. CRAFTS on "The Thickness of Cast-Iron Pipe." There are also the following experience talks:

"Notes on Erosion," by S. M. ALLIS, Supt., Malden, Mass.; "How We Painted our Stand-Pipe," by J. E. BEALES, Middleboro, Mass.; "An Experience with a Sand Blast," by J. L. HARRINGTON, Asst. Supt., Cambridge, Mass., and PHINEHAS BALL, C. E, Worcester, Mass.; "How They Put the Walking Beam into the Steamer *Puritan*," by W. M. HAWES, Water Commissioner, Fall River, Mass.; "An Experience with Water Meters," by H. G. HOLDEN, Supt., Nashua, N. H.; "Filtration," by EDWIN DARLING, Supt., Pawtucket, R. I.; "Repairs on a Wrought-Iron Pipe Main," by J. A. TILDEN, C. E., Boston, Mass.; "Raising or Lowering Large Water Pipes," by DEXTER BRACKETT, C. E., Boston, Mass.; "A Visit to the New Croton Aqueduct," by D. FITZGERALD, C. E., Boston, Mass.; "A Temporary Dam at New Bedford Water-Works," by R. C. P. COGGESHALL, Supt. New Bedford, Mass.; "A Novel Way of Placing a Bridge in Position," by C. A. ALLEN, C. E., Worcester, Mass.; "Accident on a Tile Pipe Conduit," by W. H. RICHARDS, Supt., New London, Conn.

SOCIETY PROCEEDINGS.

New England Water-Works Association.—The Eighth Annual Convention of the Association was called to order at 3 P. M., Wednesday, June 12, in Music Hall, Fall River, Mass., President NEVONS, of Cambridge, in the Chair, and Secretary COGGESHALL, of New Bedford, and about 75 members in attendance. The meeting was opened with prayer by the Rev. W. W. ADAMS; an address of welcome was made by the Hon. CHAS. J. HOLMES, and responded to by President NEVONS, after which there was a duet by Messrs. PRATT and MONROE to the piano accompaniment of Mr. MILLIGAN, all professionals of Cambridge, Mass., engaged for the occasion, and who varied the exercises with frequent songs.

The reading of the minutes of the last meeting was dispensed with; the new members were elected, after which the President's address was read which we abstract as follows:

In congratulating the association on coming together again in its eighth year of a very prosperous existence, President NEVONS called attention to the innovations he had introduced in opening the quarterly meetings and the annual convention with prayer; and also in the introduction of music to enliven and add some spice to the meetings; he thanked the officers and members of the association for their cordial coöperation and support and hoped that the precedent might be followed in the time to come. He also recommended the engagement of a permanent secretary who should give his entire time and attention to the association work, and suggested that the man best qualified for the position was the present incumbent. He thought that the association "had been in school" about long enough and queried if it was not time that a broader view be taken of the important subjects which they were called upon to consider.

He referred to the mutual benefit derived from the meetings of the past eight years and their opportunities for interchange of ideas and the discussion of the results of practical experience. These have led the members out of the difficulties and trials of their early days, when as a small gathering they met at Young's Hotel in Boston, until now, as a result of their broadened knowledge, as given in their quarterly journal, they have received the commendatory criticisms of the Boston papers, one of which says that it (the journal) treats the subject of "Water in some of its Higher Relations" entirely outside of its technical limitations and in relation to the world and life at large, and adds "whoever wishe to read one of the freshest literary essays of the season will hunt up this periodical." He further stated that the association was being recognized more each year by the best business and professional men, and in speaking of the benefits derived from the organization said there was not a city or town having water-works to which its influence had reached that had not been benefited by it. In conclusion, he thanked the members for their kind attention and urged them to guard with jealous care the interests of the association, in order that it might attain from year to year to a higher standard and usefulness.

The report of the secretary showed the membership as 209 active, 4 honorary and 64 associate, making a net gain over last year of 41, to which the new membership must be added. The treasurer's report showed the receipts to be $3,092.38; expenditures, $2,177.70, leaving a balance on hand of $964.68. After other routine business was disposed of, the first paper of the convention on "Hydrants," by GEO. A. STACY, of Marlboro, Mass., was read, and afterwards pretty thoroughly discussed. A resolution by the secretary that one hour's adjournment be made in the morning or afternoon session of Thursday, to be devoted to the inspection of the associate members' exhibits, was offered and adopted. The meeting adjourned at o'clock.

Rensselaer Society of Engineers.—The annual meeting will be held at 2 P. M., on Tuesday, June 18, 1889, at the rooms of the Society, 10 First St., Troy, N. Y. Matters of great moment to the welfare and permanency of the Society will be discussed and acted upon. A full attendance of members is specially desired.

B. E. GRANT, *Secretary.*

Engineers' Club of Philadelphia.—Record of regular meeting, June 1, 1889. Vice-President ARTHUR BEARDSLEY in the chair; 15 members and 3 visitors present. Mr. R. MEADE BACHE read an illustrated paper, by Mr. NEVILLE B. CRAIG on the Vernier Telemeter. Mr. W. A. MORSE, visitor, presented an illustrated description of the Smith Feed-Water Heater and Purifier. There was some discussion by Mr. S. S. EVANS.

HOWARD MURPHY, *Secretary.*

Statistics of Railway Construction.

SOUTHERN STATES.

(Accompanying Map No. 15 of the Progress and Prospects of Construction).

VIRGINIA—Existing Roads.

1. ***Atlantic & Danville.***—Track laid in 1888, Suffolk to Lawrenceville, 70 miles; Beaman to Sleepy Hole, 5 miles; Shoulder's Hill to Hodge's Ferry, 4 miles. Track laid in 1889, Danville east 3 miles; Hodge's Ferry to Portsmouth, 6 miles. Under construction, Lawrenceville to a point 3 miles east of Danville, 107 miles. Under survey, Claremont to Argyles, 6 miles. Projected, Danville to Bristol, 165 miles; Springs Junction to Buffalo Lithia Springs, 4 miles.

2. ***Craig Mineral.***—Under construction, Eagle Rock to New Castle, 25 miles. Projected, New Castle to Roanoke, 28 miles; New Castle to New River, 35 miles. Chief Engineer, F. A. Cooper, Eagle Rock; General Manager, W. G. Sears, Eagle Rock.

Cumberland Valley.—Under construction, Martinsburg to Winchester, 23.5 miles.

Farmville & Powhatan.—Between Clover Hill and Farmville, graded 50 miles, under contract 5 miles. President, James Hobson, Rock Castle. Chief Engineer, H. A. Whiting, Powhatan, C. H.

3. ***Norfolk & Carolina.***—Track laid in 1888, Portsmouth to Beach Grove, 15 miles; Bruce to Pig Point, 5 miles. Track laid in 1889. Drivers to Beaman's Run, 5.5 miles; Tarboro, N. C. to Tar River, N. C., 3 miles. Under construction, Beaman's Run, Va., to Tunis, N. C., 35 miles; Tar River, N. C. to Roscobel, N. C., 22 miles. President, Geo. S. Scott, New York City; Chief Engineer, E. Allen Jones, Norfolk, Va.

4. ***Lynchburg & Durham.***—Track laid in 1888, Lynchburg to Rustburg, 11 miles; in 1889, Rustburg south, 10 miles. Under construction, end of track to Durham, N. C., 93 miles. President, P. J. Otey, Lynchburg; Chief Engineer, R. Taylor Gleaves, Lynchburg.

5. ***Norfolk & Virginia Beach.***—Track laid in 1888, Virginia Beach to Ocean Park, 1 mile.

6. ***Norfolk & Western.***—Track laid in 1888, near Graham to end of track, 23.5 miles; On Flat Top Extension, 10.7 miles; ore branches on Cripple Creek Extension, 2.52; ore branches on Flat Top Extension, 10.69 miles. Track laid in 1889, end of track west, 10 miles. Under construction, on Clinch Valley Division, 78 miles. Under survey, Chambers Valley and New River Division, Ivanhoe to N. C. State Line, 40 miles.

Richmond & Chesapeake.—Projected, Richmond to Wicomico, 50 miles.

7. ***Richmond & Danville.***—Track laid in 1888, Clarksville to N. C. State Line, 4 miles.

Richmond, Fredericksburg & Potomac.—Under contract, connecting link with Richmond & Petersburg R. R., near Richmond, 8 miles.

8. ***South Atlantic & Ohio.***—Track laid in 1888, Big Cut to Clinch River, 8 miles. Track laid in 1889, Spear's Ferry to Clinchport, 2.14 miles. Under construction, Clinch River to Big Stone Gap, 28 miles.

Projects and Surveys.

Alexandria & Charleston. — Projected Alexandria, Va. to Charleston, W. Va., 240 miles; (83 Va., 145 W. Va.; President, Hon. J. S. Barbour, Washington, D. C., Secretary, John R. Reaves, Alexandria.

Lynchburg Belt.—Surveyed, around city of Lynchburg, 3.5 miles; Projected extension, 3.5 miles; President, Peter J. Otey, Lynchburg, Chief Engineer, R. T. Gleaver, Lynchburg.

Staunton & West Augusta.—Projected from Staunton to West Augusta, 20 miles; President, John D. Crowie, Staunton. Kentucky State line 100 miles; President, David S.

9. ***Virginia & Kentucky.***—Projected, Saylorsville to Pierce, Wytheville; Chief Engineer, J. C. Wrenshall, Danville.

10. ***Virginia Western.***—Projected, Eagle Rock to Kentucky State Line, 200 miles. President, A. S. Buford, Richmond. Chief Engineer, H. D. Whitcomb, Richmond.

Washington & Western.—Projected, Warrenton to Luray, 50 miles. President, F. J. Kimball; Secretary, A. J. Hemphill.

Total.—Track laid in 1888, 149 miles. Track laid in 1889, 36.6 miles. In process of construction, 438 miles. Under survey, 159 miles. Projects of some promise, 893 miles.

NORTH CAROLINA.—Existing Roads.

11. ***Albemarle & Pantego.***—Track laid in 1888, Juniper landing to end of track, 2 miles; Branch line, 4 miles; in 1889, end of 1888 track to Turnpike, main line, 4 miles; end of track to Cresswell, 8 miles. Under construction, end of 1889 track to Pantego, 14 miles.

12. ***Alma & Little Rock.***—Projected, Alma to Rowland, 20 miles.

13. ***Atlantic & North Carolina***—Projected, Goldsboro to Charlotte, 150 miles.

14. ***Atlantic Coast Line.***—Track laid in 1888, Scotland Neck south, 17.35 miles; Mile Post 18.52 to South Carolina State Line, 5.95 miles. Track laid in 1889, end of 1888 track to Bethel 6.65 miles. Under construction, Bethel to Greenville, 14 miles; Williamstown to Plymouth, 24 miles. Under survey, Greenville to Jacksonville, 65 miles. Projected, Enfield to Brinkleyville, 12 miles.

15. ***Burgaw & Jacksonville.***—Located Burgaw to Jacksonville, 30 miles. Vice-President and General Manager, Geo. A. Ramsay, Burgaw, Chief Engineer, Water G. McRae, Wilmington.

16. ***Cape Fear & Yadkin Valley.***—Track laid, in 1889, Pilot Mt. to Mt. Airy, 11.75 miles; Stokesdale to Madison, 11 miles. Under construction, Fayetteville to Wilmington, 81 miles. Under survey, Mt. Airy to Va. State line, 9.5 miles. Projected, Millboro Branch, end of track to Factory, 9 miles.

17. ***Charleston, Cincinnati & Chicago.***— Under construction, Rutherfordton to Marion 25 miles; Johnson City, Tenn. to Minneapolis, Va., 89 miles. Under survey, Marion to Johnson City, Tenn., 94 miles; Minneapolis, Va., to Breaks of Sandy, 40 miles.

3. ***Norfolk & Carolina.***—Track laid in 1888, Tunis to Aulander, 18 miles.

18. ***Ocean View.***—Track laid in 1889; Wilmington to Ocean Beach, 2 miles; President, Stacy Van Amringe, Wilmington, N. C.

7. ***Richmond & Danville.***—Track laid in 1888, Virginia State line to Durham, 52.5 miles; Jarrett's towards Murphy, 7 miles; Salem to Bethania, 8 miles; in 1889, Bethania to Rural Hall, 5 miles; High Point to Asheboro, 26 miles. Under construction, Rural Hall to Wilkesboro, 61 miles; Valley Town to Murphy, 23 miles; Winston to Mocksville, 27 miles. Under survey, Asheboro to Richmond, 99 miles. Projected, Lenoir to Blowing Rock, 16 miles.

19. ***Roanoke & Southern.***—Track laid in 1889, Winston to Walnut Cove, 18 miles. Under construction, Walnut Cove to Martinsville, Va., 42 miles. Projected, Winston-Salem to Monroe, 110 miles; President, John D. Spencer, Martinsville, Va.

20. ***Seaboard Air Line.***—Track laid in 1888, Cameron to Carthage, 10.2 miles; between Henderson and Durham, 37 miles; Monroe to South Carolina State line, 13 miles; end of track to Lewistown, 3.5 miles. Track laid in 1889, between Henderson and Durham, 7 miles.

21. ***Southern & Western Air Line.***—Graded, Shelby to Burke Co. line, 24 miles. Under construction, Burke Co. line to Cranberry, 76 miles; President, S. McD. Tate, Morgantown; Chief Engineer, J. N. Wilson, Morgantown.

22. ***Suffolk & Carolina.***—Projected, Ryland to Edenton, N. C., 20 miles.

23. ***Wilmington Sea Coast.***—Track laid in 1888, Wilmington to Ocean, 9.25 miles; President, William Latimer, Wilmington, N. C.

Projects and Surveys.

24. ***Asheville & Bristol.***—Projected Asheville to Bristol, Tenn., 83 miles. Chief Engineer, T. Coleman, Asheville, N. C.

25. ***Atlanta, Asheville & Baltimore.***— Projected, Asheville, N. C., to Roanoke, Va., 200 miles. President, Natt Atkinson, Asheville.

26. ***Atlantic, Henderson & Virginia.***— Projected, Henderson to Atlantic Coast Line, 40 miles. President, Wm. H. S. Burgwyn, Henderson.

27. ***East Carolina Land & Railway Co.***— Projected, New Berne to Wilmington, 90 miles. President, Claudius E. Foy, New Berne, N. C.

28. ***Great Western Air Line.***—Projected, Charlotte to Durham, 125 miles.

29. ***Statesville Air Line.***—Surveyed, Spartanburg, N. C., to Danville, Va., 190 miles; President, J. J. Mott; Chief Engineer, W. A. Eliason, Statesville.

Total.—Track laid in 1888, 210 miles. Track laid in 1889, 80 miles. In process of construction, 496 miles. Under survey, 528 miles. Projects of some promise, 747 miles.

SOUTH CAROLINA.—Existing Roads.

14. ***Atlantic Coast Line.***—Track laid in 1888, N. C. State line to Rowland, 2.97 miles; Sumter southwest, 19.7 miles. Under construction, end of track, 19.7 miles; from Sumter, to Orangeburg, 35 miles. Under survey, Orangeburg to Augusta, Ga., 50 miles.

30. ***Carolina, Cumberland & Chicago.***—Track laid in 1888, Aiken to Edgefield, 25 miles. Under survey, Edgefield to Asheville, N. C., 125 miles; Gen. Manager W. H. Schofield, Aiken, S. C.

31. ***Carolina, Knoxville & Western.***—Track laid in 1888, Greenville to end of track, 14 miles. Graded, Augusta, Ga., to Greenville, 115 miles. Partly graded, end of track to Knoxville, Tenn., 140 miles. Receivers, Jas. T. Williams and Chas. Z. McCord, Greenville.

17. ***Charleston, Cincinnati & Chicago.***—Track laid in 1888, near Kershaw to Blacks, 84.7 miles. Surveyed, Blacks to Augusta, Ga., 151 miles.

32. ***Columbia, Newberry & Laurens.***—Under construction, Columbia to Newberry, 42.5 miles; 21 miles graded. Surveyed, Newberry to Rutherfordton, N. C., 160 miles. President, H. C. Mosely, Prosperity, Chief Engineer, Charles Ellis, Jr., Columbia.

33. ***Eutawville.***—Track laid in 1888, Vances to Santee river, 2.25 miles. Under construction, Santee river to Sumter, 33 miles.

34. ***Green Pond, Walterboro & Branchville.***—Track laid in 1888, Walterboro north, 2 miles.

35. ***Mt. Pleasant & Seaview City.***—Under construction, Charleston to Seaview City, 7 miles. President, Robert C Gilchrist, Charleston, S. C., Chief Engineer, S. Lewis Simons.

20. ***Seaboard Air Line.***—Georgia, Carolina & Northern.—Track laid in 1888, N. C. State line to Chester, S. C., 32 miles. Surveyed, Chester, S. C. to Atlanta, Ga., 217 miles.—Palmetto Branch—Projected, Cheraw to Columbia, 80 miles.

36. ***South Bound.***—Blackville, Newberry & Alston.—Track laid in 1888, Salleys to Seivern, 14 miles. Under survey, Seivern to Columbia River, 33 miles. Surveyed, Barnwell to Savannah, Ga., 140 miles. President, Mike Brown, Barnwell, S. C.

Projects and Surveys.

37. ***Camden, Chester & Gaffney.***—Projected, Gaffney City to Camden, 85 miles. President, J. V. Sarratt, Chester.

38. ***Eastern, Barnwell & Western.*** — Projected, Charleston to Augusta, Ga., 125 miles.

39. ***Hartsville.***—Located, Hartsville to Cheraw & Darlington R. R., 10 miles. President, J. L. Coker, Hartsville, S. C.

40. ***Mt. Pleasant, Santee & Little River.***—Projected, Conway to Charleston, 100 miles.

41. ***Orangeburg & Lewiedale.***— Projected, Orangeburg to Lewiedale, 60 miles. President, R. C. Barkley. Chief Engineer, H. T. Peake, Vances, S. C.

Total.—Track laid in 1888, 197 miles. In process of construction, 273 miles. Under survey, 644 miles. Projects of some promise, 450 miles.

GEORGIA.—Existing Roads.

42. ***Augusta & Chattanooga.***— Surveyed, Augusta, Ga., to Chattahoochee River, 140 miles. Projected, Chattahoochee River to Chattanooga, Tenn., 100 miles.

43. ***Atlanta & Florida.***—Track laid in 1888, Atlanta to Fort Valley, 74 miles. Projected, Fort Valley to Cordele, 42 miles.

44. ***Birmingham & Atlantic Air Line.***—Graded, between Macon and Dublin, 40 miles. President, W. E. H. Searcy, Griffin; Chief Engineer, H. S. Watt, Macon.

45. ***Central Railroad & Banking Company of Ga.***—Track laid in 1888, on Savannah & Western Division, 7 miles. Under survey, Savannah to Americus, 185 miles. On Buena Vista & Ellaville, track laid in 1889. Upatoi Creek to Buena Vista, 26 miles.

46. ***Chattanooga, Rome & Columbus.***—Track laid in 1888, Chattanooga, Tenn., to Rome, Ga., and Cedartown to Carrollton, 118 miles. Surveyed, Carrollton to Columbus, 101 miles. Projected, Kingston to Augusta, 187 miles; Cedartown to Atlanta, 55 miles.

47. ***Chattanooga Southern.***—Track laid in 1889, Chattanooga, Tenn., to State Line, 3 miles. Under construction, State Line to Eagle Cliff, 5 miles. Under survey, Eagle Cliff to Alpine, 20 miles. President, W. Crutchfield, Chattanooga, Tenn. Chief Engineer, E. S. Wittman.

Columbus.—Track laid in 1888, in and around city of Columbus, 8.10 miles.

48. ***Columbus Southern.***—Under construction, Columbus to Albany, 87 miles, 53 miles graded. Chief Engineer, W. S. Greene, Columbus, Ga.

49. ***Covington & Macon.***—Track laid in 1888, Monticello to Athens, 62 miles. Under construction, Monticello to Griffin, 37.5 miles.

50. ***Darien Short Line.***—Under construction, Darien to Josephine, 40.5 miles. President, R. H. Walker, Darien, Ga.

51. ***Dover & Statesboro.*** Under construction, Dover to Statesboro, 10 miles. Projected, Statesboro to Way-Cross, 100 miles. President, Fred Lockhart, Augusta, Ga. Chief Engineer, Gordon Gairdner.

52. ***East Tennessee, Virginia & Georgia.***— Projected, Jesup to Jacksonville, Fla., 98 miles.

53. ***Empire & Dublin.***—Track laid in 1889, Empire northeast 12 miles. Under construction, end of track to Dublin, 18 miles; Empire to Hawkinsville, 12 miles. President, J. C. Anderson, Chattanooga, Tenn.

54. ***Gainesville & Dahlonega.***—Projected, Gainesville to Dahlonega, 26 miles.

55. ***Georgia Southern & Florida.***—Track laid in 1888, 10 mile post to 150 mile post, 140 miles. Under construction, Valdosta to Lake City, Fla., 60 miles. Under survey, Lake City, Fla., to Palatka, Fla., 75 miles; Projected, Tifton to Thomasville, 55 miles. President, Wm. H. Wells, Macon, Ga.

56. ***Lexington Terminal.***—Under construction, Lexington to Crawford 3.5 miles. President, Hamilton McWhorter, Lexington.

57. ***Midville, Swainsboro & Red Bluff.***—Track laid in 1889, Midville to Swainsboro, 20 miles. Projectected, Swainsboro to Red Bluff, 38 miles. President, Jesse Thompson, Augusta, Ga.

58. ***Ore Belt.***—Under construction, Cedartown to Cave Spring, 15 miles. President, A. Richardson, Cedartown, Ga., Chief Engineer, Percy Lumly.

59. ***Rogers & Summit.***—Track laid in 1889, Rogers to Stillman, 32 miles. Projected, end of track to Reidsville, 21 miles, President, Wm. O. Wadley, Rogers, Ga., Chief Engineer, J. D. Overstreet.

60. ***Rome & Decatur.***—Track laid in 1888, end of '87 track to Alabama State line, 5 miles.

61. ***Savannah, Americus & Montgomery.***—Under contract, Abbeville to McRae, 25 miles. Under survey, McRae to Savannah, 165 miles. Chief Engineer, R. E. Hardaway, Americus. Capt. J. N. Bass, Supt.

62. ***Savannah, Florida & Western.***—Track laid in 1888, Thomasville to Monticello, Fla., 24 miles.

63. ***South Brunswick Terminal.***—Under construction, South Brunswick to Waynesville, 16 miles; Projected, Waynesville to Cordele, 160 miles. President, John E. Holly, New York, Sec., E. P. Kennard, New York.

64. ***Union Point & White Plains.***—Under construction, Union Point to White Plains, 13 miles.

65. ***Winterville & Pleasant Hill.***—Track laid in 1888, Dunlap to Smithonia, 7 miles. Projected, Smithonia to Danielsville, 15 miles. President, Jas. M. Smith Winterville.

Projected and Surveys.

66. ***Alabama, Georgia & Florida.***—Projected, Bainbridge to Columbus, 110 miles.

67. ***Alpharetta & Marietta.***— Projected, Alpharetta to Marietta, 18 miles.

68. ***Athens & Jefferson.***—Located Athens to Jefferson, 18.5 miles. President, R. B. Russell, Athens, Ga.; Sec. R. L. Moss.

69. ***Atlanta & Alabama.***—Surveyed, Atlanta to Selma, Ala., 180 miles.

70. ***Atlanta, Atlantic & Great Western.***—Surveyed, Atlanta to Savannah, 250 miles. President, Geo. T. Fry, Atlanta, Ga.

71. ***Cleveland.*** — Projected, Cleveland to Lula, 17 miles. President, W. B. Bell, Cleveland.

72. ***Cumming & Warsaw.***—Projected, Cumming to Norcross, 18 miles.

73. ***Etowah Valley.***—Under construction, Gainesville to Dawsonville, 25 miles. Under survey, Dawsonville to Kingston, 50 miles. Chief Engineer, P. B. Lawrence, 50 Ellis St., Atlanta.

74. ***Hawkinsville, Americus & Eastman.***— Projected, Hawkinsville to Georgia Southern & Florida R. R., 18 miles. President, J. D. Stetson, Hawkinsville.

75. ***Madison & Eatonton.***— Projected, Madison to Eatonton, 22 miles. President, John Crutchfield, Macon.

Rome Belt Line—Projected, Belt Line at Rome, 5 miles.

Total.—Track laid in 1888, 433 miles; Track laid in 1889 120 miles. In process of construction, 372 miles. Under survey, 1,041 miles. Projects of some promise, 1,187 miles.

(CONCLUDED NEXT WEEK.)

RAILWAYS.

EAST OF CHICAGO—Existing Roads.

New York, Ontario & Western.—This company has awarded the contract for building the tunnel through the mountain range which divides the waters of the Delaware and Susquehanna rivers, near Walton, N. Y. to Ward & Leary. The tunnel is to take the place of the "zig-zag" which is now used to carry the roads up the eastern slope of the mountains. It will be about 1,600 ft

long, with approaches of 2,000 ft. at each end. The grade will be reduced from 104 ft. per mile to 75 ft. per mile and the road shortened about 2 miles.

Long Island.—Tracklaying has been completed on the 4-mile extension to Oyster Bay.

Central Dock & Terminal Co.—This company has been incorporated in the interest of the New York Central & Hudson River and the Philadelphia & Reading railway companies to construct a 5¾ mile terminal railway in the city of Buffalo, N. Y.

Greenwich & Johnsonville.—The engineers have completed the surveys for the proposed extension of this road from Greenwich to Granville, N. Y.

Keyport.—About 1 mile of the extension from Lorillard's to Atlantic Highlands, N. J., has been graded ready for the rails. There will be 6 bridges on the route, the longest being 325 ft.

Evansville, Suburban & Newburg.—This 11½ mile dummy line, running from Evansville to Newburg, Ind., was formally opened for traffic, May 31.

Evansville & Terre Haute.—The graders on the Evansville & Richmond R. R. have reached Seymour, Ind.

Cleveland, Akron & Columbus.—The contract for grading the 3-mile branch of this road, from near Akron, O., to a coal mine, has been let to Kissner, Cook & Co. It is expected to have it completed by July 1.

Cleveland, Cincinnait, Chicago & St. Louis.—Articles of incorporation have been filed consolidating the Cleveland, Columbus, Cincinnati & Indianapolis and Cincinnati, Indianapolis, St. Louis & Chicago railway companies under the above name.

Mt. Gretna.—A dispatch from Lebanon, Pa., states the narrow-gauge road from Mt. Gretna Park to the top of Governor Dick Mountain, is nearly completed, and will be opened for traffic soon. The road starts from a point near the main station in Mt. Gretna Park, skirts along the shore of Lake Conewago, and proceeds by a tortuous course along the southern and western slopes of the mountain to the top, a distance of 7 miles.

New York, New Haven & Hartford.—The Connecticut Legislature has passed the bill authorizing this company to increase its capital stock $35,000,000.

Toledo, Saginaw & Mackinaw.—The surveyors are making rapid progress on the line from Bay City, Mich., to Tawas City, a distance of about 55 miles. They report a favorable route, free from heavy cuts or grades.

East Broad Top.—An extension of the Shade Gap R. R., running from Rockhill to Shade Gap, Pa., to Mifflintown or Port Royal, is reported to be under consideration.

Somerset.—The contract for the extension of this railway from Carratunk Falls to Bingham, Me., a distance of 7¾ miles, was awarded to I. C. Mills, of Starks, Me., on June 1. The grading is to be completed in four months from date, and the work is already well under way.

Projects and Surveys.

Gouverneur & Southern.—This company has been organized in New York to build a railway from Gouverneur to the village of Fine, a distance of 25 miles. Locating surveys are in progress. WALTER F. RANDALL, of Oneida, N. Y., is Chief Engineer.

Harrisburg Terminal.—Incorporated in Pennsylvania to build a road from Bowmansdale, Cumberland county, across the Susquehanna river to Harrisburg, a distance of 9 miles.

Buffalo, Lackawanna & Pacific.—A number of the business men of Niagara Falls, N. Y., have made a protest to the officers of this road against the proposed location through the business portion of the town. The road is projected to run from the Grand Trunk yards in Buffalo, to Niagara Falls, about 12 miles. JOSEPH RICHARDSON, of New York, is President.

Castine Railway & Navigation Co.—This is the new name of the Castine & Bangor R. R. Co., organized to build a railway from Castine to Bangor, Me., a distance of 37.7 miles. Steps are being taken to begin the construction of the road. JAS. ADAMS, of Bangor, is President.

North Stratford Southern.—A bill is to be presented to the New Hampshire Legislature, incorporating a company to build a railway from North Stratford, Coos county, to a point on the St. Johnsbury & Lake Champlain R. R., near Scott's Station. The proposed line would form a connection between the Boston & Lowell and the Upper Coos railways.

SOUTHERN.—Existing Roads.

East Tennessee, Virginia & Georgia.—The Briarfield, Blocton & Birmingham R. R. has been located from Montevallo, Ga., to Blocton, 25 miles, and it is stated that construction will commence at once.

Richmond & Danville.—It is announced that this company will build a branch road from Yorkville to Sharon, S. C.

Seaboard Air Line.—It is stated that the Georgia, Carolina & Northern R. R. Co. has placed its bonds and will begin construction at once.

Savannah, Dublin & Western.—This bankrupt Georgia road was offered for sale, with an upset price of $50,000, at public auction on June 4, but no bids were received. It will be put up for sale again on July 2, without an upset price.

East & West of Alabama.—The work of widening the gauge of this road is progressing rapidly. It is stated that several new iron bridges will be built and considerable work done in reducing the grade. The survey for the extension to Birmingham will commence soon.

Vicksburg & Northeastern.—This company has been reorganized to build a railway from Vicksburg to Columbus, Miss. Under the name of the Vicksburg, Canton & Yazoo City R. R. the company graded, laid the ties and built the bridges on 23 miles of the line from Vicksburg to Canton, in 1873, when work was stopped. A portion of the old roadbed of the Mississippi Central will be used by the new company, and this, with the 23 miles already graded, will leave only about 150 miles of new road to build. J. J. COWEN, of Vicksburg, is President.

Rogers & Summit.—It is stated that this company has commenced work on the extension from Stillmans to Reidsville, Ga., 25 miles.

Projects and Surveys.

Bessemer & Birmingham.—Incorporated in Alabama to build a line of railway from Birmingham to Selma, Ala., a distance of about 130 miles. Among the incorporators are: H. L. MCKEE, of Montgomery, and A. W. CAWTHORN, of Selma, Ala.

Alabama, Georgia & Florida.—A corps of engineers under the charge of Maj. W. S. GREENE, have commenced the survey of this road, from Columbus south along the abandoned grade of the Bainbridge, Cuthbert & Columbus Railway; C. G. JORDAN, of Columbus, Ga., is interested.

Bangor & Blountsville.—A project is being agitated to build a railway from Bangor Station on the Louisville and Nashville R. R. to Blountsville, Ala., a distance of about 12 miles.

THE NORTHWEST.—Existing Roads.

Chicago, Rock Island & Pacific.—The annual report of this company for the year ending April 1, 1889, shows the following results from operations:

Gross earnings	$17,562,505
Operating expenses and taxes	13,166,176
Net earnings	$4,396,329

To these net earnings is to be added $1,660,930, derived from the sale of lands, etc. Interest on bonded debt, rentals, dividends and premiums amounts to $7,031,493, leaving a deficit of $974,234.

Pacific Short Line.—The following are the officers of the Nebraska division of this road: President, MILLARD R. JONES, of New York; Vice-President, D. A. MCKENZIE, of New York; Treasurer, E. H. STONE, of Sioux City; and Secretary, T. W. TOMLINSON of New York.

Northern Pacific.—The surveys are completed and bids for grading advertised for, for the extension of the Jamestown & Northern R.R. from Minnewaukan to Leeds Station, 18 miles.

Northern Pacific & Manitoba.—The contractors expect to have the bridge across the Assiniboine river near Portage completed and track laid to Portage by June 15.

Winona & Southwestern.—At the annual meeting of the stockholders recently held, the following officers were elected: President, WILLIAM WINDOM; Vice-President, H. W. LAMBERTON; Secretary, M. G. NORTON, and Chief Engineer, D. M. WHEELER.

Duluth Incline.—Tracklaying has begun on this short line of railway at Duluth, Minn.

St. Louis, Alton & Springfield.—This company has filed a second mortgage of $300,000 on its franchise, rolling stock, etc., to the Farmers' Loan & Trust Co., of New York. The money is to be used in building an independent line from Loammi to Springfield, Ill.

Centralia & Ste. Genevieve.—This road is now in operation from Sparta to Coulterville, Ill.

Belleville, Centralia & East St. Louis.—C. H. SHARMAN, of St. Louis, Mo., sends us the following information:

The locating surveys have been nearly completed for this road which is to run from Belleville, Ill., to Mt. Vernon, Ill., a distance of 67 miles. The work is light; maximum grade, 40 ft. per mile, and maximum curve 6°. There will be two iron bridges of about 100-ft. span each. Contracts will probably be let this month, and it is expected to have the road in operation by December. D. J. MACKEY, Gay Building, St. Louis, Mo., is President.

Projects and Surveys.

Yankton, Norfolk & Southwestern.—JAS. H. TELLER, of Yankton, Dak., President, has sent us the following:

The surveys have been completed for this road, which is to run from Yankton, Dak., to Norfolk, Neb., a distance of 70 miles. The route is through a rolling prairie country well adapted to agriculture. The maximum grade is 50 ft. per mile and the maximum curve is 5°. A portion of the right of way has been secured. The road is being built principally by English capital. The contracts will be let June 10, and it is expected to have the road opened for traffic by Dec. 1, 1889. D. C. RICE of Yankton, is Chief Engineer.

St. Louis, Quincy, Omaha & Sioux City.—At a meeting of the projectors of this road, recently held, the following officers were elected: B. F. STEARNS, of New York, President; J. C. RICHARDSON, of St. Louis, Vice-President; JOSIAH FOGG, of St. Louis, Secretary; THEODORE WEED, of New York, Treasurer; and Jas. F. PEAVEY, of Sioux City, General Manager. It was voted to make an issue of $12,000,000 of stock and to begin work on the surveys at once. The road is projected to run from Sioux City, Ia., to St. Louis, Mo.

THE SOUTHWEST.—Existing Roads.

New Orleans, Fort Jackson & Grand Isle.—About 300 men are now at work on the construction of this Louisiana road. CHAS. S. DWIGHT, 25 Carondelet St., New Orleans, is Chief Engineer.

Kansas City & Southern.—It is stated that this company will extend its line from Osceola to Bolivar Mo., a distance of 49 miles.

Texarkana Northern.—Work on the extension of this road is in progress. The line is projected to run from Kansas City via Fort Smith to Texarkana and thence south to Sabine Pass. Ten miles of the road is already in operation.

Dallas, Pacific & Southeastern.—About 26 miles of this road has been graded ready for the rails.

Chicago, St. Paul & Kansas City.—It is stated that this company will build a branch from St. Joseph, Mo., to Leavenworth, Kan., to connect with the Kansas City, Wyandotte & Northwestern R. R.

St. Louis, Alton & Terre Haute.—The annual report of this company for the year ending Dec. 31, 1888, shows the following results from operations:

Gross earnings	$949,307.48
Operating expenses and taxes	548,571.35
Net earnings	$400,736.13

Houston, Central Arkansas & Northern.—Track has been laid on this road from Monroe to Columbia, La., a distance of 20 miles, and this portion of the road will be opened for traffic early in July.

Projects and Surveys.

Sulphur Springs & Red River.—We have received the following information concerning this enterprise from C. B. STEPHENSON, of Sulphur Springs, Tex.

Surveys are now in progress on this road. The route is through a rolling prairie country for about 43 miles. The remainder of the road, 17 miles, runs through a fine timber belt. The principal business will be in cotton, grain, coal and timber. The towns of Sulphur Springs and Cooper have subscribed $20,000 cash, each, and granted right-of-way. G. B. BOOMER, of Sulphur Springs, can give information in regard to letting contracts for building the road.

Union & Northwestern.—The engineers have reached Farmerville, La., in the survey of this road from Monroe to Camden, Ark. URIAH MILLSAPS, of West Monroe, La., is President.

San Angelo Northern.—A project is on foot to build a line of railway from San Angelo, Tex., north to a junction with the Texas Pacific R. R., a distance of about 100 miles.

Hempstead & Brazos.—A railway company by this name is to be incorporated in Texas.

ROCKY MT. AND PAC.—Existing Roads.

Union Pacific.—This company has called a meeting of the directors to consolidate the Utah Central, the Utah & Northern, the Oregon Short Line, the Salt Lake & Western, the Utah & Western, the Utah & Nevada, and the Ogden & Syracuse railway companies, under a single corporate organization.

Southern Pacific.—Work will soon commence on the extension of the Tracy branch on the west side of the San Joaquin valley, a distance of 31 miles.—The extension of the Northern California is being pushed.

Northern Pacific.—Keefe, Green & Co., who have the contract for building the Gallatin-Butte branch, have sublet the contract for building the bridges and houses along the route to Matthews Bros. & Kerrock, of Minneapolis, Minn., for $160,000.

Oregon Railway & Navigation Co.—The contract for building the Spokane Falls & Rockford branch has been let to Kilpatrick Bros. & Collins, who have sublet the contract for grading the line to J. H. Smith, of Spokane Falls, and the bridging to J. L. Smith and McKenzie & Co. Work is to begin at once.

Ilwaco & Shoalwater Bay.—This road from Ilwaco to Baker's bay, Ore., has been completed to Naratta, a distance of 16 miles. Five miles of this was completed in 1888.

Santa Fé Southern.—This company is contemplating the building of an extension from Santa Fé, N. M., to San Pedro.

RAPID TRANSIT.

Electric Railways.—*Beverly, Mass.*—Hon. JOHN I. BAKER has been elected President of the Beverly & Danvers Electric Street Ry. Co.

Bristol, R. I.—The Sprague Electric Ry. Co. has made a proposition to build an electric line to Forestville and Plainville.

Jamaica, N. Y.—The electric railway from Brooklyn to Jamaica has been purchased by I. B. NEWCOMBE.

Troy, N. Y.—The Troy & Lansingburg Street Ry. Co. has made a contract with the Sprague Co. for electric equipment.

Washington, D. C.—The Georgetown & Tenleytown Electric Ry. Co. has ordered rails from the Johnson Co.,

of Johnstown, Pa. Gen. R. C. DUNN is President, and JOHN E. BEALL, Secretary.

Nashville, Tenn.—The Suburban Electric Ry. Co. has been organized by W. M. FLEMING, and others, of New York. Capital stock, $2,000,000.

Atlanta, Ga.—The Fulton County Ry. Co. has made a contract with the Thomson-Houston Co. for electric equipment.

Birmingham, Ala.—The Birmingham Union Ry. Co. is contemplating adopting electricity. A company has been formed to build an electric line, using the Sprague system. W. B. COPELAND is Secretary.

Peoria, Ill.—The Central Ry. Co. has been granted a franchise for an electric railway. The rails are to be supplied by the Johnson Co., of Johnstown, Pa.

Sioux City, Ia.—The Covington, Sioux City & Dakota City Street Ry. Co. will change its line from horse to electric traction.

St. Louis, Mo.—The Lindell Ave. Ry. Co. is building the extension of its electric line to Forest Park.——The Bridge & Tunnel Co. proposes to build an electric line over the bridge.

Wichita, Kan.—The Wichita & Suburban Street Ry Co. made a trial run on its electric line June 5. The Sprague system is used.

Dallas, Tex.—The Dallas Circuit Ry. Co. is proposing to adopt an electric system.

Portland, Ore.—The Willamette Bridge Ry. Co. and the Metropolitan Street Ry. Co. have awarded contracts to the Northwestern Electric Supply & Construction Co., of Seattle, W. T., for 3½ and 5 miles of electric railway respectively.

Ellensburg, W. T.—An electric railway is projected. A. S. GROSS is interested.

Seattle, W. T.—The Woodland Park Electric Ry. Co. has been incorporated by G. C. PHINNEY, DANIEL JONES, and B. F. DAY. Capital stock, $100,000.

The Thomson-Houston Electric Co. has recently closed contracts as follows: Fulton County Street Ry. Co., of Atlanta, Ga., 8 miles, 8 cars; Attleboro, North Attleboro & Wrentham Street Ry. Co., of Attleboro, Mass., 8 miles, 5 cars; Americus Street Ry. Co., of Americus, Ga., 4 cars; Auburn Street Ry. Co., Auburn, N. Y., 3 cars The company has now 50 lines in operation and under contract.

Cable Railways.—*Washington, D. C.*—The Washington & Georgetown Ry. Co. has been granted permission to convert its 7th St. line to a cable system. The Johnson Co., of Johnstown, Pa., has the contract for rails.

Cleveland, O.—Work on the double track line on Superior St. is to be commenced shortly. The road will cost about $1,000,000. FRANK ROBISON is interested.

Dummy Lines. *Sheffield, Ala.*—The Sheffield Street Ry. Co will extend its line about 2 miles, and will purchase 2 dummy engines.

Mobile, Ala.—The Mobile & Spring Hill Ry. Co. will extend its dummy line into the city.

Asheville, Ala.—The Ashville & Whitney Ry. Co. has been organized to build a dummy line. President, L. F. ROSE; Secretary, JAMES F. GREEN; General Manager, T. C. YATES.

Atchison, Kan.—The Atchison Rapid Transit Co.'s dummy line has been sold to W. L. CHALLIS for $4,667.

Elevated Railway.—*Jersey City.*—A company to build an elevated road from the Jersey Central ferry to Bergen Heights has been incorporated by ALFRED C. CHENEY and HIRAM HITCHCOCK, of New York City, CHARLES T. HARVEY, of Nyack, N. Y., and others. Capital stock, $750,000.

CONTRACTING.

Pipe Laying.—The following proposals for laying submerged water pipe have been received by Capt. Geo. H. COOK, U. S. A., Davids' Id., N. Y.: John F. Ward, Jersey City, N. J., $13,200 with Ward's patent joint, with stops; John Sheehan, New Rochelle, N. Y., $13,000 with McNeal joint; A. H. Coon, Kingston, Pa., $13,375 with Ward joint; Geo. H. Townsend, Boston, $15,900 with Ward joint; C. McLean, New York, $26,965 with Ward joint; J. Cornwell Jr., New York, $20,750, with Ward joint; $17 800 with Cornwell joint, $15,500 without wood casing. The contract was awarded to J. F. Ward.

Contractors' Addresses.—Elsewhere we have advertised for the cards and permanent addresses of the leading contractors for public works throughout the American continent. A great many of these are already on our subscription list, but are not known to us as contractors except as we check them over from other lists; many also buy their papers from the newsdealers, and so we fail to get their names or addresses. We are preparing lists of such contractors as may be considered national rather than strictly local, and hence we apply to these for their addresses. These lists will be issued gratuitously before the close of the year and circulated where they will be of most benefit to the contractors themselves. It is hoped that a liberal and prompt response will be made to enable us to make a full and accurate list of the enterprising men who are performing so large a part in the subjugation of this continent to the needs of the highest civilization the world ever saw.

Sewers.—*New Rochelle, N. Y.*—The following proposals were opened June 1 by Mr. HORACE CROSBY, C. E.: Fogg & Scribner, New York, $24,608.38; Molloy Bros., New Rochelle, $33,491.79; Adam Miller, Saratoga, N. Y., $34,477.32; J. R. Byron, Mt. Vernon, $36,497.25; John Curran & Co. New York, $37,716.85; John B. Doyle, Saratoga, N. Y., $38,014.94. Georzi & O'Grady, $38,604.20; Troy Public Works Co., L'd, $40,831. The contract will probably be let to the lowest bidder, Fogg & Scribner, whose prices are as follows: 6, 8, and 18-in. sewer, including excavation, back filling and pipe laid, 50 cts., 67 cts., $1.37 per ft.; 6-in. temporary outlets, 55 and 60 cts per lin. ft.; 4-in. spurs for house connections, 56, 59, 67 cts. and $1.57 per ft. extra; 350 upright spurs, 53 cts. per ft. extra; 520 4-in Y branches for all sizes, $1.50 each; 1,000 lbs. iron pipe, 5 cts. per lb.; 20 manholes, $40 each; 11 flushtanks, $89 each; 16 lampholes and 24 blind lamp holes, $15 each; 5,000 ft. B. M. lumber, $40 per M; 50 cu. yds. concrete, $6 per cu. yd; 10 cu. yds. rubble masonry, $10; 3,225 cu. yds. rock, $2.50; manholes, Nos. 9 and 11, $212 each. There will be 3,172 ft. of 6-in., 7,670 ft. of 8-in., and 1,654 ft. of 18-in., 450 6-in. temporary outlets, and 4,064 ft. of house connections. It was originally proposed to discharge the sewage into a tank and then into the harbor, but the State Board of Health disapproved of the plan, and it is now intended to extend the outfall beyond the harbor and to discharge the sewage into the deep water of the Sound.

Phillipsburg, N. J.—The following are the prices of bids for sewers received June 3: M. O. Hagen, Phillipsburg: $6.91 per ft. for 681 ft. each of 4 ft. x 6 ft. brick sewer A and B, 49¼ cts. for 50 ft. of 12-in. pipe, 55 cts. per cu. yd. for 20 cu. yds. of rock, 5 cts. per lb. for iron castings, $3 75 per cu. yd. for 30 cu. yds. of concrete, 75 cts. per ft. for 27 ft. of manholes, $1.25 per ft. for 24 ft. of basins. Mutchler & McHale, Phillipsburg: $9 and $9.25 for brick, $1.25 for pipe, $1 for rock, 6 cts. for castings, $4 for concrete, $3.50 for manholes, $200 for basins complete. McCormack & Monohan, Phillipsburg: $15.70 for brick, 95 cts. for rock, 5 cts. for castings, $5.75 for concrete, 56 cts. for manholes, $95 for basins. T. M. Lescher, Easton, Pa.: $9.50 for brick, $45 for manholes, $100 for basins, P. T. Brennan, New York City: $6.90 for brick, $40 for manholes, $125 for basins. There will be 3 manholes and 3 basins. C. PH. BASSETT, of Newark, N. J., is the Consulting Engineer.

Yankton, Dak.—The following proposals have been received by E. D. PALMER, City Engineer: M. Sykes, Minneapolis, Minn., $6,217.36; M. Whitten, Sioux City, Ia., $6 237.44;—Forrestal, St. Paul, Minn. $6,526.96;—Grimwood, Yankton, $7,594.78; Greenleaf, Huron, Dak., $10,850; Money & Yateman, Sioux City and Yankton, $11,200; Cushing & Lloyd, Sioux Falls, Dak., $12,600; M. Clark, Minneapolis, Minn., $12,913.60. The contract was awarded to Mr. SYKES.

Jail.—The Stanislaus County Supervisors, Modesto, Cal., have ordered an election for June 22 on the proposition to issue $100,000 in bonds for a county jail, hall of records, etc.

Railway Work and Bridges.—The Sears Construction Co., of Eagle Rock, Va., which has the contract for the construction of the Craig Mineral Ry. from Eagle Rock to Roanoke, has awarded the contract for grading the first 10 miles to McCarthy & Ross. The masonry was let to C. Rosazza & Co. The 1,500 M ft. of trestling will be let to an experienced man on personal application. There are 4 spans of iron bridge to let, specifications for which will be sent to bridge companies on application. About 10 miles of grading, in 1 or 2 mile sections, will be let about June 20; prices and specifications will be furnished on application.

Machinery for Locks.—The following proposals for machinery for Lock No. 8, Monongahela river, were opened June 6 by Lieut.-Col. W. E. MERRILL, U. S. Engineer Office, Cincinnati, O.: Lambert Bros. & Co., Ironton, O.: 7 cts. per lb. for 17,021 lbs. of wrought iron, 7⅞ cts. per lb. for 35,618 lbs. of cast iron, 12¼ cts. per lb. for 786 lbs. of steel, $3,889.83. Hoefinghoff & Lane Foundry Co., Cincinnati, O.: 9¼, 6, and 27 cts., $3,906.29. Vulcan Iron Works, Chicago, Ill.: 10⅝, 5⅞, and 17⅞ cts., $4,068.35. I. & E. Greenwald Co., Cincinnati: 7¾ cts. for all, $4,140.44. West Point Mfg. Co., West Point, Pa.: 9¼, 7¾, and 9 cts., $4,448.12. Detrick & Harvey, Baltimore, Md.: 7¾, 8¼, and 15 cts., $4,464.56. John G. Fritsch, Cincinnati: 10⅞, 7⅞, and 11⅞ cts., $4,473.77. Universal Radial Drill Co., Cincinnati: 9.45, 9, and 29 cts., $5,042.04.

Plank Roads.—The County Commissioners, at Whatcom, W. T., have let the contract to Harris & Co., to build the plank toll-road from Whatcom to Lynden. The distance is about 14 miles, and the road will cost about $2,100 per mile. Another plank road from Bellingham bay to Lake Whatcom will be constructed on the toll plan.

Plumbing Work.—The following bids have been received at Salt Lake City, Utah, for the plumbers' work connected with the Salt Lake water mains and service pipes for one year from June 1, under these conditions: the city to deliver all the water mains at the trenches and supply the necessary calking tools, furnaces, yarn and lead; the contractor to lay the piping in the trench run the joints, and calk. For the services, the city to furnish tapping machine, and the contractor to tap the mains for service pipes, dig trenches four feet deep, furnish the best lead, standard gauge, extra strong service pipe, averaging not less than specified weights, with guaranteed tensile strength of 425 lbs. under pressure per sq. in. The bids numbered three, as follows:

Sizes Mains.	*D. James. cts.*	*Midgley & Sons. cts.*	*Heesch & Ellerbeck. cts p. ft.*
8-in. joints	18	27⅛	27
6-in. "	17	23	22
4-in. "	16	19	18
3-in. "	15	16	15
Services.			
1½-in. pipe (cast-iron) averaging 5 lbs. per ft	25	28	32
1-in. (lead) averaging 4¾ lbs. per ft	28	80	38
¾-in. (lead) averaging 3½ lbs. per ft	27	30¼	32
⅝-in. (lead) averaging 3 lbs. per ft	26	27¼	30
½-in. (lead) averaging 2½ lbs. per ft	25	21¼	27½

PROPOSALS OPEN.

Dredging.—About 159,000 cu. yds. N. H. HUTTON, Engineer. HON. F. C. LATROBE, President of the Harbor Board, Baltimore, Md. June 19.

Boilers.—Three steel 6-flued boilers, W. L. THOMPSON, Secretary, City Work House, Cincinnati, O. June 19.

Sewers.—From 12,000 to 20,000 ft. of sewers, W. C. CLARK, Chairman, Board of Selectmen, Westfield, Mass. June 20.

Bridge.—A combination bridge, 1 span of 100 ft., 18 ft. roadway, no footwalk. E. T. HERRICK, County Clerk, Williamsport, Dak. June 21.

Bridge.—Iron bridge over the Trinity river. E. G. BOWER, Dallas, Tex. June 22.

Water-Works.—Including reservoir and about 45,000 ft. of 4 to 14 in. iron pipe and 16,000 ft. of 12-in. vitrified pipe. Plans and specifications on file. A. E. PIERCE Secretary of Board of Water Commissioners, Westfield, N. Y. June 27.

Bridge.—Wooden drawbridge over Vermillion bayou 150 ft. long, 12. ft. wide, J. T. BROUSSARD, Abbeville, La. June 28.

Sewers.—Terra-cotta pipe, concrete and brick sewers; also receiving basins. THE DISTRICT COMMISSIONERS, Washington, D. C. July 1.

Dredging.—In Penobscot river. Lieut.-Col. JARED A. SMITH, U. S. Engineer Office, Portland, Me. July 2.

Steel Work.—Steel superstructure of the King St. subway, WM. CARLYLE, Chairman, Committee on Works, Toronto, Ont., Canada. July 2.

Building.—Court house and city hall. Cast-iron columns and steel beams: also granite and brick. LONG & KEES, Architects. THE BOARD OF COURT HOUSE AND CITY HALL COMMISSIONERS, Minneapolis, Minn. Iron work, June 18. Brick and granite, July 2.

Bridges.—One iron, 80 ft. span; 2 wood or combination, 100 and 56 ft. long, 24 and 30 ft. spans; 1 pile bridge 80 ft. long. H. A. LANGLIE, County Auditor, Caledonia, Traill Co., Dak. July 8.

Bridges.—Across 4 creeks. THE COMMISSIONERS OF HUMBOLDT COUNTY Eureka, Cal. July 9

MANUFACTURING AND TECHNICAL.

Car Heating.—The Williames Car Heating Co., of Boston, was organized in May to control the Williames system of heating railway cars with steam from the engine. President, HUGH MCMILLAN, of the Michigan Car Co., Detroit; Treasurer and General Manager, R. G. CHASE, Boston; General Agent, R. B. OWEN, recently with the Martin Anti-Fire Car Heater Co.

The Paul Whitin Mfg. Co., of Rockdale, Mass., is building a new factory 188 x 77 ft., 4 stories high, with boiler and 2 engine houses, etc. About 35 tenements will also be built. A. C. MOORE, C. E., of Southbridge, Mass., is in charge.

Granite.—The Booth Bros. & Hurricane Isle Granite Co., of 60 Bank St., New York City, is supplying the granite and executing the mason work of the reservoir at New Albany, Ind., under the charge of Mr. JOHN DONALDSON, the Secretary. The work is progressing well and will be completed by or before the end of the year.

The Pintsch Gas Lighting System.—The Safety Car-Lighting & Heating Co., 160 Broadway, New York, has recently had its system adopted as follows: the Shore Line Ry., 48 cars: Chicago & Atlantic, 48 cars: Pullman Palace Car Co., 38 cars: Wagner Car Co., 60; New York Central, 54; New York & New England, 25; and the Dom Pedro II Ry., in Brazil, 25 cars. The Erie Ry. has 246 cars lighted with gas, and the West Shore Ry. 145 cars. The New York & New England Ry Co. has changed its entire equipment from oil to gas lighting. The New York Central Ry. Co. has completed works at Mott Haven, N. Y., to supply gas for its cars. The system has also lately been put in the boats of the Hoboken ferry, 4 boats of the Stonington line and 70 United States Government buoys.

Coldwell, Maxwell & Co. have a new and completely equipped foundry and machine shop at Newburg, N. Y.

There are 2 30-ton overhead cranes extending the whole length of the buildings.

The Cleveland Pipe Works Co. has elected the following officers: President, N. G. WATTERSON; Treasurer, J. C. CAULFIELD; Secretary, B. C. STARR.

Timber.—The Southern Timber Co., of Mobile, Ala., has a contract for sawing 7,000,000 ft. of lumber for the Nicaragua canal.

The American Bituminous Rock Co. has been organized at Louisville, Ky., by JOHN F. REYNOLDS, and others. Capital stock, $1,000,000.

Steel Works.—The Carpenter Steel Co. will use the Philadelphia & Reading rail plant at Reading, Pa. Mr. J. H. CARPENTER, of New York, is President.

Cement.—A contract has been closed with Messrs. Plankinton & Yates, of Milwaukee and Omaha, for the erection and operation of a Portland cement factory, at Yankton, Dak. The plant is to cost $100,000, and the factory to start with a working force of 100 men. About 400 acres of land will be required.

Docks and Piers.—The South Beach Pier Co. has been organized by ADOLPH L. KING, H. A. WARD, HENRY A. OCKERHAUSEN, and others, to build docks, wharves, etc., at Southfield, Richmond Co., N. Y. Capital stock, $15,000.

Asphalt.—The North American Asphalt Co., of St. Louis, Mo., is developing the asphalt deposits at Thistle, near Salt Lake City, Utah. The beds are 12 or 14 ft. thick. The rock is broken in mills and then crushed between rolls; it is then ready for use, being laid on a concrete or broken stone foundation and consolidated by rolling.

Signal.—The Fontaine Crossing & Signal Co., of Toledo, O., has brought out an automatic signal for indicating the time that has elapsed since the passage of a train. This signal registers the time up to 20 minutes, and is put in operation by the passage of a locomotive wheel over a small track instrument.

Car Coupler.—A company has been organized at Yorkville, S. C., by Q. J. HOKE, to introduce his patent coupler.

Gas Pipe Line.—A line of steel gas main is to be laid between Pittsburg and Murraysville by the Philadelphia Co. A 36-in. riveted steel pipe costs, it is said, about $10,000 less per mile than cast-iron pipe. The line will be 34,000 ft. long and contain 2,000 tons of ¼-in. steel pipe.

Steel Ties.—The Standard Steel Railway Tie & Construction Co. has moved its New York office from 151 Broadway to 15 Cortlandt St. The tie manufactured by this company is a cross-tie of channel section, with a block of preserved wood, on end grain, under each rail; the rails are secured by clamps held together by a horizontal bolt. The ties are to be made by Carnegie, Phipps & Co., of Pittsburg. The company gave its first annual dinner June 8, at which several engineers and railway men were present. Mr. MCGEEHAN is the Engineer, and Mr. SPENCER the General Manager of the company.

Grading Machine.—Miller & Bierce, of Memphis, Tenn., want to purchase an improved grading machine.

Electric Motors.—E. Crippen, 37 Natchez St., New Orleans, La., wants prices on electric motors, 1 to 10 H. P.

Cars.—The Michigan Car Co., of Detroit, Mich., is building 600 box cars, 34 ft. long, 60,000 lbs. capacity, for the Toledo, St. Louis & Kansas City.

The Ellis Car Co., of Amesbury, Mass., has shipped 2 open cars to the Merrimac Valley road, at Lawrence.

The Indianapolis Car Works, of Indianapolis, Ind., have an order in hand for the Jacksonville & Southeastern.

The Union Pacific will soon give out orders for 16 dining cars.

Railway Material.—The Greystone Granite & Construction Co., of Raleigh, N. C., wants 25 miles of 25 or 30 lb. rails, 1 locomotive and 10 flat cars; standard gauge.

S. G. CULPEPPER, of Adel, Ga., wants 4 or 5 miles of 30 lb. rails.

Rails.—The Bethlehem Iron Co., of Bethlehem, Pa., has an order for 40,000 tons of steel rails for an Oregon railway.

BRIDGES AND CANALS.

La Fayette, Ind.—The following proposals for the new Main St. bridge have been received by EVERETT B. VAWTER, Engineer of the County Commissioners: Detroit Bridge & Iron Works, $30,900; Lane Bridge & Iron Works, Chicago, $26,776; with steel joists, $31,096; Champion Bridge Co., Wilmington, O., $35,800, complete; Massillon Bridge Co., Massillon, O., $31,011.86, complete; Columbia Bridge Co., Dayton, O., $47,68 per lin. ft. (542 ft.), $25,842; Indiana Bridge Co., Muncie, $27,112; Pittsburg Bridge Co., Pittsburg, Pa., plan A, $25,750; plan B, $27,750; plan C, $30,750; LaFayette Bridge Co., plan A, $41,000, complete; plan B, $38,319, complete: plan C, $36,639.50; plan D, $32,000; plan E, $24,000; King Iron Bridge & Mfg. Co., Cleveland, O., plan A, $27,650; plan B, $28,805; extra for steel floor, joists and eye beams, $3,600; extra for steel joists for floor only, $2,100; Milwaukee Bridge & Iron Works, plan A, $29,674; plan B, $28,555; plan C, $32,000; Canton Bridge Co., Canton, O., plan A, $26,865.18; plan A-1, $27,232.21; plan A-2, $26,960.02; plan A-3, $30,370.50; plan A-4, $30,730; plan A-5, $30,054.40; Smith Bridge Co., Toledo, O., plan A, complete, $29,000; plan B, complete, $27,000; deduct for lattice rail, $5,000. The contract was awarded the La Fayette Bridge Co. for $26,639.50.

Vernon, Ind.—The following proposals have been received by J. C. COPE: P. Ensminger, Brookville, Ind.; (wood) $17.97 and $15.79 for 126 ft. spans, $11.37 for 50 ft.; Queen City Bridge Co., Cincinnati, O., $26 and $21.95, $16; Mt. Vernon Bridge Co., Mt. Vernon, O., $26.40 and $23.50, $11.60; Champion Bridge Co., Wilmington, O., $3,420.50, $3,225, totals; Columbus Bridge Co., Columbus, O., $26.20 and $21.50, $10.60; Lane Bros., Newark, O., $27, $12.50; St. Louis Bridge Co., St. Louis, Mo., $22.50 and $21.85, no bid for 50 ft.; Massillon Bridge Co., Massillon, O., $21.75 for 126 ft., $11 for 50 ft.; Wisconsin Bridge Co., Milwaukee, Wis., $26 for 126 ft.; J. F. P. Brackett, Cincinnati, O., $23.15, $10.82; Pittsburg Bridge Co., Pittsburg, Pa., $22.75, $11.50; Variety Iron Works, Cincinnati, O., $22.95, $11.70; Milwaukee Bridge Co., Milwaukee, Wis., $23, $11; Mitchell Bridge Co., Rochester, Ind., $11, $8, wire cable; Canton Bridge Co., Canton, O., $23.40, $11.95; Lane Bros., Chicago, Ill., $21.80 and $21.09, $10.12; Columbia Bridge Co., Dayton, O., $24.75, $22.25, $21 and $20.75 for 126 ft. $10 for 50 ft. The contract was awarded to the Columbia Bridge Co.

Viaduct.—*Kansas City, Kan.*—The construction of the Armstrong viaduct across the Union Pacific and Rock Island yards has been decided upon. It will be 1,700 ft. long and 32 ft. wide. The cost will be $70,000, of which the city will pay half and the railway companies a quarter each.

Boston, Mass.—The following proposals were opened June 1 by City Engineer JACKSON: For iron railing on Harvard bridge: Manly Mfg. Co., Dalton, Ga., $1.47 per lin. ft.; Chelmsford Foundry Co., Chelmsford, Mass., $1.48; G. W. & F. Smith Iron Co., Boston, $1.64; Geo. T. McLaughlin, & Co., Boston, $1.66½; Smith & Carleton, Boston, $1.68; D. H. Andrews, Boston, $1.68; Builders' Iron Foundry, Providence, R. I., $1.90; T. M. Ham & Co. Boston, $1.91; P. J. Dinn, Boston, $1.93; Smith & Lovett, Boston, $2.60. The contract was awarded to the Manly Mfg. Co.——For widening the draw opening of the Neponset bridge: J. N. Hayes & Co., Boston, $6,400; Josiah Shaw, Somerville, $6,480; John Cavanagh & Co., Braintree, $6,900. The contract was awarded to J. N. Hayes & Co.

Bridge Notes.—*Brattleboro, Vt.*—The new iron bridge over the Connecticut river to Chesterfield, N. H. has been completed. It has one span of 320 ft. and cost about $12,675; it was built by the Berlin Iron Bridge Co.

Clifton Park, N. Y.—The Highway Commissioners will build 3 iron or stone bridges.

Elizabeth, N. J.—The Board of Freeholders will build an iron drawbridge at Summer St. over the Elizabeth river for $10,000.

Plainfield, N. J.—A bridge will be built on Grant Ave. at a cost of $1,000.

Williamsport, Md.—The Cumberland Valley Ry. will build a new iron bridge across the Potomac.

Parkersburg, W. Va.—The County Commissioners are again considering the project for a Little Kanawha river bridge.

Asheville, N. C.—The West Asheville Toll Bridge Co. has awarded the contract for a bridge over the French Broad, to the Wrought Iron Bridge Co., of Canton, O., for $14,000.

Petersville, Ind.—The County Commissioners have let contracts for the substructure and superstructure of a new bridge at $4,217.88 and $3,036.76 respectively.

Venice, Ill.—Work is in progress on the east caisson for the Merchants' bridge to St. Louis, Mo.

Baraboo, Wis.—It is proposed to issue bonds to pay for a new bridge across the Baraboo river.

Eau Claire, Wis.—It is proposed to build another bridge over the Chippewa river, at 4th Ave.

Canton, Dak.—The Milwaukee Bridge Co. is building a new bridge over the Sioux river.

Astoria, Ore.—Hoffman & Bates are preparing to build the bridge for the Astoria & South Coast Ry.

Dallas, Tex.—The County Commissioners will rebuild the Commercial St. bridge.

Anaheim, Cal.—M. Ledbetter, of Los Angeles, has the contract for a bridge over the Santa Ana river, at $8,445.

Crescent City, Cal.—The San Francisco Bridge Co. has a contract for a railway bridge over Smith river. The price is $23,000. The bridge will be 730 ft. long and 14 ft. wide, with 5 spans, 2 of 220 ft. each, 1 of 96 ft., and 2 of 97 ft. exclusive of approaches.

Chambly, Que.—Proposals for bridge masonry have been received by JOSEPH TRUDEAU as follows: Raymond & Barsalow, St. Hubert, $9.75 per cu. yd.; Jos. Dubine, Napierville, $14, in blocks, erecting the pier as per plans and specifications; I. R. Labelle, Ste. Rose, $8 per cu. yd. The contract was awarded to I. R. Labelle.

Highland Falls, N. Y.—The Berlin Iron Bridge Co., of East Berlin, Conn., is putting up 2 iron bridges; one of these has a concrete floor, no wood at all being used.

Laredo, Tex.—An iron bridge of 100 ft. clear span, with a roadway and 2 sidewalks, has been built by the Berlin Iron Bridge Co., of East Berlin, Conn., and shipped to Laredo. This is the second shipment of the kind that the company has made to Texas.

ELECTRICAL.

Electric Light.—*Rockville, Conn.*—A number of electric light companies have made propositions to the gas company to put in an electric plant.

Windsor Locks, Conn.—It is proposed to establish an electric light plant, probably in connection with the water-works. Mr. H. C. DOUGLAS is interested.

Buffalo, N. Y.—The Council is discussing the cost of different systems of electric lighting.

Far Rockaway, N. Y.—Several franchises for electric light have been applied for from the Village Trustees.

Patchogue, N. Y.—The Electric Light Co. is extending its lines and will soon have 400 incandescent lights in operation.

Baltimore, Md.—The only bids for electric lighting were from the Waterhouse Electric Co. and the Brush Electric Light Co. The contract for 1 year has been awarded to the latter.

Florence, S. C.—The Florence Electric Light & Power Co. has been organized by GEO. B. EDWARDS, of Charleston and others.

Cincinnati, O.—It is proposed to put up a plant with a capacity for supplying 2,000 arc lights, 300 of which are to be put in at once.

Pierre, Dak.—The Hawkeye Electric Light Co., of Davenport, will put in a plant.

Butte, Mont.—The Butte City Electric Co. will put in a complete new incandescent electric light plant with a capacity of 750 lamps of 16 c. p. each. These lights will be operated on a separate circuit and will have no connection with the arc circuit.

San Pedro, Cal.—The San Pedro Electric Light & Power Co. has been incorporated by E. E. PECK, R. D. SEPULVEDA and J. H. DODSON. Capital stock, $100,000.

Omaha, Neb.—The Council has received the following bids for lighting the streets for 5 years:

Western Street Lighting Co., $21 per lamp per year. Omaha Gas Mfg. Co., $25 per lamp per year. New Omaha Thomson-Houston Electric Light Co., 100 lamps, 5 years contract, $175 per lamp per year; 150 lamps, 5 years contract, $165; 200 lamps, 5 years contract, $160. For 16 c. p., $22; for 20 c. p., $25; for 25 c. p., $28. Omaha Illuminating Co., 100 lamps, 55 cts. per night for each light of 2,000 c. p.; 300 lamps, 16 c. p., $22,50 per light. Omaha Gas Mfg. Co., incandescent electric lights, 30 c. p., $26 for each light. Sun Vapor Light & Stove Co., $18.48 per lamp per year.

The Thomson-Houston Electric Co., of Boston, Mass., reports a number of orders for arc and incandescent lamps for cities and for isolated plants.

The Heisler Electric Light Co., of St. Louis, Mo., manufacturer of the Heisler long distance incandescent system, has issued a new illustrated catalogue, which may be obtained on application. The catalogue contains articles from different papers, descriptive of plants in various cities, and there are a number of testimonials. Among the illustrations are maps showing the location of the lights in Wabash, Ind., Matteawan and Fishkill, N. Y., Vincennes, Ind., and Red Bank, N. J. A list is given of the most important central stations. The lights are used for street, business, and residence lighting.

WATER AND MUNICIPAL.

Atlanta, Ga.—There is considerable agitation at present over the water question, as an additional supply is needed, and several plans have been suggested. Mr. HILYER is in favor of moving the works to a location on Nance's creek, while the mayor, Mr. GLENN, is in favor of the river as the source of supply. It is said that there is no trouble as to the immediate supply of water, but the main point is to secure a surplus for a future supply. It is proposed to appropriate $10,000 for the purpose of investigating the means of procuring an additional supply, and a committee has been appointed, headed by Mr. W. A. HEMPHILL, to look into the matter. The following is an estimate made by Mr. HILYER for the Nance's creek location:

NANCE'S CREEK ESTIMATE.

20 million gallon engine, pump and boilers for same and pump house	$ 75,000
5 miles 36-in. main	176,320
20 acres service reservoir	60,000
Water privileges and right of way	5,000
Moving old main and setting to service	25,000
Moving present pumps and setting to service and for pump house at service reservoir	10,000
Moving and setting filters and tank	10,000
	$361,320
Credit present site	60 000
Balance net expenses of new works	$301,320

Filters.—The Jewell Pure Water Co. has secured the contract for filtering 2,000,000 galls. daily at Appleton, Wis. At a meeting of the Directors of the Light, Heat & Water Co., of Jackson, Miss., on June 3, the contract to filter the water of the Tennessee river for the city water-works was awarded to Monsin, Allen &

Co., of New York City, general Eastern agents for the Jewell Pure Water Co.

Gas Works.—*Rochester, N. Y.*—The Municipal Gas Co. has acquired control of the Rochester Gas Light Co. by the purchase of $590,000 of the $600,000 stock of the latter. The Citizens' Gas Co. is still independent, but negotiations for acquiring it have been made by the Municipal Co.

Fayette Co., Pa.—The Virgin Run Gas Co. has been incorporated at Harrisburg to supply gas to Dawson, Connellsville, Uniontown, Dunbar, New Haven and Broadford. Among the stockholders are SAMUEL C. and W. HARRY BROWN, of Pittsburg. Capital stock, $10,000.

East Liverpool, O.—Knowles, Taylor & Knowles are putting in a Loomis gas plant.

Pine Bluff, Ark.—A franchise for gas works has been applied for by N. M. JONES, J. O'CONNELL and H. P. BRADFORD.

Nasaya, Nicaragua, C. A.—Congress has authorized the contract made with Messrs. Clirnie & Pimentel for supplying the city of Nasaya with water.

Pawtucket, R. I.—The Water Commissioners have issued their report for 1888. During the year several hundred feet of pipe have been laid and 17 hydrants set; also 271 services metered. There are about 5,084 services and 3,098 meters in use. The total amount of water pumped during the year was 1,554,238,516. The report contains several statistical tables and a report on the analysis of the water by Prof. DROWN of the Massachusetts Institute of Technology. It is also illustrated with a portrait of Mr. EDWIN DARLING, the Superintendent, and 7 views of the pumping stations, reservoirs, etc.

St. Paul, Minn.—The Water Commissioners have issued their report for 1888. During the year, 28 miles 3,392 ft. of mains was laid, and the high-service reservoir designed by J. T. FANNING and H. H. HARRISON was completed; 1,218 new services were put in. There are now 131 miles 3,876 ft. of mains, 1,134 fire hydrants, 162 street sprinkling hydrants, 1,199 gates, 284 meters and 7,235 services. The superintendent recommends the laying of 31 miles 540 ft. of mains during 1889, and the estimate of cost for pipe castings, hydrants, gates, trenching, and laying complete is $276,730.50. The amount of water pumped was 484,507,680 galls. A plan is given, prepared by Mr. J. T. FANNING, showing the flow and friction losses in water pipes in a section of the city. JOHN CAULFIELD is Secretary and J. B. OVERTON Superintendent.

Jamestown, R. I.—The 12-in. iron outlet pipe has been laid and the sewerage system completed. There are 6, 8, and 12-in. glazed pipe. The plans and specifications were prepared and the work carried out by Mr. WM. H. LAWTON, Jr., C. E., and Mr. CORRIGHAN.

Indianapolis, Ind.—The Indianapolis Water Co. has purchased 60 acres of land around the water gallery, and a 24-in. main will be laid from the gallery to the city. A new pumping station is to be built in which will be engines of 16,500,000 galls. daily capacity, while at the lower station the capacity will be 18,000,0000 galls., making a total capacity of 34,500,000 galls. per day. There will be, as soon as the new line is laid, 3 forcing mains, of these one is a 20-in., the others 24-in. There are now over 70 miles of distributing pipe, and when the new ines are in, there will be a total of over 90 miles.

Water Works.—*Massachusetts.*—Holyoke. Work is in progress on the dam for the new reservoir; it will be 1,900 ft. long, 21 ft. high, 7 ft. wide at top and 15 ft. at the base; it is built of rubble masonry. Mr. ELLSWORTH, City Engineer, is in charge, and Delaney Bros. are the contractors. The total cost will be $80,000.

Rhode Island.—Wakefield. The Wakefield Water-Works Co. is laying mains on North Main St.——East Providence. The supply main burst recently.

New York.—Albany. The plans for the new engine-house have been prepared by Parfitt Bros., architects, of Brooklyn, and approved by Mr. DE VERONA, the engineer.——Syracuse. The vote on the proposition to issue $3,000,000 in bonds for water-works to be built and owned by the city, the supply being taken from Skaneateles lake, resulted in 11,302 for and 910 against the proposition. Moffett, Hodgkins & Clarke, of Watertown, N. Y., made a proposition to establish and maintain works; the rates to be the same as at Rochester.——Sidney. The Sidney Water Co. proposes to bring water from a reservoir 2 miles east of the village.——Brockport. Water-works are projected.——Cazenovia. L. W. LEDYARD, J. STEBBINS and CHAS. M. POTTER for the committee appointed to consider the question of establishing water-works.——Jamaica. The Jamaica Township Water Co., of which Mr. LOCKWOOD is President, will extend its mains.——Fort Edward. A new main will be laid to the island, to replace the one which burst last winter.——Silver Springs. Water-works are projected. W. H. CUMMINGS is interested.

New Jersey.—Newark. The Commonwealth Water Co. has been incorporated by EUGENE VANDERPOOL, C. PH. BASSETT and FREDERICK FRELINGHUYSEN. Capital stock, $100,000.——Blairstown. JOHN I. BLAIR proposes to build water-works; the supply will be taken from wells and pumped to a stand-pipe 12 or 15 ft. diameter and 90 or 100 ft. high.——Long Branch. The company has accepted MAYOR BROWN'S offer to personally assume the responsibility of the city's indebtedness.——Jersey City. Mr. JOHN R. BARTLETT recently explained the Montclair Water Co.'s scheme at a public meeting, and a committee consisting of Dr. L. J. GORDON, JAMES FLEMING, and others, was appointed to confer with Mr. BARTLETT.—— Plainfield. At a special meeting of the Council held this week, the specifications for a water supply prepared by Mr. RUDOLPH HERING, C. E., were read, and after some discussion the matter was postponed till the meeting of June 21 for further consideration.

Maryland. Catonsville. The Catonsville Water Co. has awarded the contract for an additional stand-pipe to Bartlett & Hayward, of Baltimore, for $8,500.

District of Columbia.—Washington.—The hotel men have recently protested against the enforcing of the meter regulations, but Commissioner RAYMOND has reported that it is necessary that the regulations be enforced, as the new 48-in. main will not furnish an unlimited supply.

Virginia.—Lynchburg. A new 4,000,000 galls. pumping engine has been put in to force water to the College Hill reservoir, which is 300 ft. above the pumping station.——Hampton. The contract for the new works has been let to Crook & Horner, of Baltimore, Md.; they will furnish an engine and boiler and 8,000 ft. of 10-in. pipe for $13,000.——Petersburg. The damage done to the water-works by the flood will be repaired at once.

Georgia.—Fort Valley. The works to be built by Capt. J. A. HOUSER and others will cost about $15,000.——Americus. A new reservoir is to be built.——Gainesville. JOHNSON and CRUSELLE are making surveys for the proposed works.

Alabama.—Florence. W. F. INMAN, of New York proposes to build water-works on the stand-pipe system.——Bessemer. The DeBardeleben Coal & Iron Co. is building another reservoir.——Decatur. The new works have been completed and water has been turned on.

Tennessee.—Chattanoogn. The Chattanooga Water & Power Co. has invited bids for building water-works. President, JOHN R. DEAN.——Knoxville. The KNOXVILLE Water Co. will put in new boilers and extend its mains.

Ohio.—Marion. A reservoir is to be built, and a site is now being selected.

Indiana.—Columbus. The new engine was tested June 1, with satisfactory results.

Michigan.—Kalamazoo. The city has awarded contracts for 266½ tons of pipe and 8 tons of castings to the Detroit Pipe & Foundry Co., of Detroit, Mich., for $7,200.92.——Ypsilanti. Trial wells have been put down and a good flow of water obtained for the proposed works.

Illinois.—Peoria. The Peoria Water Co., in which Moffett, Hodgkins & Clarke, of Watertown, N. Y., are interested, will begin work at once, prospecting for water. The incorporators are CHESTER B. DAVIS, WM. H. FRITCHMAN and NICHOLAS E. WORTHINGTON. The capital stock is $1,000,000.——Pekin. About 1,100 ft. of pipe extensions are to be laid.——Alton. The water is said to be in very bad condition and to need filtering.——Ottawa. The South Ottawa Water-Works Co. has been incorporated by THOS. E. MACKINLAY, C. B. HESS, and THOS. C. FULLERTON. Capital stock, $100,000.——Norwood Park. The brick tower is completed; the tank will be 36 ft. high.——Pinckneyville. Water-works are to be built.——Carlyle. The case between the city and the Carlyle Water, Light & Power Co. is now before the Circuit Court. The city claims that the pipe furnished was not what the specifications called for, that the water was not thrown as high as it should be, and that the boilers furnished were second-hand. The plant was erected in 1887. There are about 70 plugs, 3¼ miles of mains, an engine house, and a stand-pipe 115 ft. high. The city was to pay an annual rental of $2,100. The opinion of the citizens is that this is too much.

Minnesota.—Bryn Mawr. This suburb of St. Paul will have its own works, costing $25,000 to $30,000. There are 10 tube wells and the water will be pumped to a tank of 50,000 galls. capacity; 4 miles of mains are being laid.

Kansas.—Argentine. The Argentine Water & Electric Light Co. has been organized by A. KLEIN, J. P. BYRNE, and T. ENRIGHT. Capital stock, $150,000.

Nebraska.—Orleans. The water-works have been tested and accepted by the city.——Tekamah. Water-works are projected.——Grant. The wells have been sunk and the contract for pipe laying has been let to B. F. Clark, of Ashland.

Montana.—Helena. The East Side Water Co. has to close the gates of its reservoir at night in order to let enough water collect to furnish a small supply during the day. The Woolston Co. is said to have a limited supply during the present dry time.

Missouri.—St. Charles. The water company will lay new mains in several streets.

Colorado.—Denver. The Denver City Water Co. has applied for a 20 years' extension of its present contract with the city. The Real Estate Exchange has adopted a resolution to the effect that no exclusive franchise should be granted, but that the city should own its works.

Utah.—Ogden. A special committee has been appointed to consider the proposition made by the Bear River Canal Co. to supply the city with water.

Ontario.—St. Catharine's. Proposals will be received June 17, for $30,000 30 years water-works debenture. Address W. A. MITTLEBERGER, Treasurer.—— London. Contracts have been let for the new residence for the pumping engineer; the cost will be $1,694.——Toronto. Contracts have been awarded as follows: valves, Rice Lewis & Son, and R. A. Dempster, of Manchester; 48 and 60-in. flexible joints, Camden Iron Works, $130.40 and $188; 4, 6 and 12-in. pipe, St. Lawrence Foundry, $40, $38, and $37.50; 36-in. pipe, A. Gartshore, of Hamilton, $37.50; pumping-engine of 3,000,000 galls. daily capacity, with boilers, Blake Steam Pump Co., Boston, $28,980; 48 and 60-in. steel plate pipe, S. Warden, of Syracuse, $7.25 to $10.15.——Ottawa. Hanson Bros., of Montreal, have purchased the new issue of Ottawa corporation water-works bonds, at 98.92. The amount is $150,000, for 20 years at per cent.

Irrigation.—*Colorado.* The Hindsware Ditch & Reservoir Co. has been incorporated at Denver by B. S. HIND, H. V. WARE, J. Q. ADAMS, and others. Capital stock, $5,000. The company will operate in Garfield Co. and demands 2,000 ins. of water from Elk creek.——The Loma & Garita Ditch Co. has built a hanging flume.

Montana.—The Chestnut Valley Canal Co., has been incorporated at Helena, Mont., by ALBERT KLEINSCHMIDT, J. D. MCINTYRE, and WALTER N. GRANGER. Capital stock, $75,000. The object is to construct and maintain a ditch, tapping the Missouri river in Cascade Co. at a point at the head of Half Breed rapids, and conveying the water in a northern direction a distance of about 30 miles. This enterprise will open up a section of fine farming land.

New Mexico. — The Fort Sumner Land & Ditch Co., capital stock $100,000, has been incorporated by LON HORN and D. L. TAYLOR, of Trinidad, SAM DOSS, of Fort Sumner, A. T. BACON, of Greely, Col., and F. A. MANZANARES, of Las Vegas. The company owns the old army reservation about Fort Sumner, capable of being mad highly productive when the waters of the Pecos river are brought upon it. The reservation comprises about 19,000 acres and was sold by the Government at $2.50 per acre. When the irrigating ditches are completed it will be marketed at from $10 to $20 per acre.

California.—The Fresno Canal & Irrigation Co., W. H. INGELS, Secretary, will build a canal 25 miles long, requiring the moving of about 800,000 yds. of dirt.—— The Orange Grove Water Co. has been organized at Pomona, by C. E. WHITE, GEO. E. ROSS, and W. H. SANDERS. Capital stock, $240,000.——The survey of the Sunset canal has been commenced. The point of diversion will be near the summit of the lake, about 16 miles north of Huron, in Fresno Co. One main canal will run towards the Little Panoche and the other toward Tulare lake, passing near Huron. Both ditches will cover some of the best land in the State. The ditches are to be 100 ft. wide and 80 miles long.

Drainage and Dams in Connecticut.—Hill & Palmer, engineers, of Bridgeport, Conn., are preparing dredges, etc., to reclaim about 4,000 acres of salt meadows in the old town of Stratford, east of Bridgeport, with perhaps a considerable length of dikes and creeks across the meadows. An association has been formed to carry out this work. Mr. B. H. HILL, State Engineer, has, by request, been making examination of a number of dams in the State, the recent disaster having aroused considerable anxiety as to the condition of these structures.

Filters.—The following proposals have been received by the Water Board at Newburg, N. Y.: Oliphant Filter Co., $24,000; National Filter Co., $30,000; Hyatt Pure Water Co., $39,000, for a complete plant. The contract was awarded to the Hyatt Co., there being only one negative vote.

Terre Haute, Ind.—The Wabash Valley Natural Gas & Fuel Co. has been granted a franchise and right of way for mains for supplying gas for domestic fuel.

Brockton, Mass.—The Water Commissioners have issued their report for 1888. Trouble has been experienced with vegetable growth and a report on the same has been made by the State Board of Health. The commissioners are in favor of mechanical filtration, and they give an abstract of a report on filter systems made by the Water Board of Lowell. An experimental Jewell filter has been in use. During the year 8,680 ft. of mains 13 gates, 11 hydrants, and 130 meters were set; there are now 34.15 miles of pipe, 291 gates, 304 hydrants, 11.77 miles of service pipe, and 1,283 meters. W. F. CLEAVELAND is Superintendent.

Nashville, Tenn.—It is said that the capacity of the filter at the Upper Id. is inadequate to supply the 10,000,000 galls. per day required by the city, the cause being, according to the report of Mr. JOWETT, City Engineer, that the filter is not long enough and does not cover sufficient filtering area. With the new engine, there will be a pumping capacity of 20,000,000 galls. per day, and the filter cannot be extended to furnish this supply.

Water Power.—*Winnipeg, Man.*—Mr. J. T. FANNING, C. E., has made an investigation and will report shortly. The minimum power will be about 3,750 H. P. at low water. The dam will give 24 ft. fall at low water The cost will be about $350,000.

Wellfleet, Neb.—The Wellfleet Real Estate & Improvement Co. has advertised for estimates and plans for building a dam on the Medicine creek at Wellfleet. The water will have a fall of 40 ft. and will furnish power for a turbine water wheel and electric dynamos, and will also run the machinery of the beet sugar factory.

Cohoes, N. Y.—The Cohoes Co. will build a dam 75 ft. long and 22 ft. high to catch the water now being wasted into the river at the rear of the Tivoli mills. A tunnel 400 ft. long will connect the dam with the tube works level, through which the water now wasted will be conducted and augment the force needed to give power to the tube works. Ira Parker, of Waterford, has the contract. The cost will be about $12,000.

Burlington, Vt.—The Water Department has issued its report for 1888. In July work was commenced on the new reservoir of 4,000,000 galls. capacity, plans and specifications for which had been prepared two years before by Superintendent PARKER, and by the end of the year was so far advanced that the use of the old reservoir was discontinued. W. H. Lang, Goodhue & Co., of Burlington, were the contractors. It is recommended to improve the old reservoir and connect the two. There are now 93,803 ft. of cement and 65,094 ft. of iron pipe; 163 hydrants, 266 gates and 445 meters. Mr. F. H. CRANDALL, the Superintendent, is to be commended for giving a complete summary of statistics in the form suggested by the New England Water-Works Association. Uniformity in the style of reports is much to be desired, and this form should be more extensively followed than it is.

Artesian Wells.—***Athol, Mass.***—A well is being put down by Barrett & Webster, contractors, of Orange.

Georgetown, D. C.—The Virginia Artesian Well Co. has struck a good flow of water at a depth of 85 ft. The company is putting down 2 wells at Roslyn, Va.

Abbeville, Ga.—Money has been subscribed for sinking an artesian well.

Melbourne, Fla.—A well for the Melbourne & Atlantic Ry. Co. has been put down by J. A. Durst.

Key West, Fla.—The Key West Water Supply Co. will put down a well.

Gate City, Ala.—The well has a flow of 400,000 galls. per day.

Uniontown, Ala.—The well has been put down 920 ft. and has struck water.

Martinsville, Ind.—Another well is to be put down by E. Henderson and T. H. Parks.

Des Moines, Ia.—A flow of water was struck recently by a well on S. S. SMITH'S land near Bayard.

Vinton, Ia.—The well is 1,282 ft. deep and cost $4,138.50 for drilling, exclusive of tubing.

Jamestown, Dak.—The Trustees of the Insane Asylum have let a contract for a 6-in. well to Lupler Bros., of Pingree, for $7,000.

Groton, Dak.—It is proposed to issue bonds for $15,000 for an artesian well.

Pueblo, Col.—The well put down on the heights by L. C. Frey has struck water.

Stromsburg, Neb.—Wells are to be sunk to a depth of about 135 ft.

Grant, Neb.—A local company is to be organized to sink artesian wells.

Waco, Tex.—The Waco Artesian Investment Co. has been incorporated by WM. BRENSTADT, E. ROTAN, and F. W. FORT. Capital stock, $60,000.

Sherman, Tex.—M. H. ANDREWS wants proposals for artesian wells to increase the water supply.

Velasco, Tex.—Wells are to be put down. Address J. B. RUNYAN.

Dallas, Tex.—The Dallas Rapid Transit Ry. Co. wants proposals for putting down a well 3,000 ft. deep.

Beebe, Ark.—H. B. Barger, of Coal Hill, has a contract to sink a well for F. P. Laws.

Anderson, S. C.—The Anderson Ice Co. will put down a system of gang wells.

Special Reports of Water-Works.

Booth Bay Harbor, Me.—We are informed that works will be built this summer, with J. W. STARR, 303 Walnut St., Philadelphia, Pa., as contractor.

Fort Fairfield, Me.—N. H. MARTIN has sent the following:

The Frontier Water Co. has recently been organized to build the works started some time ago. Part of the pipe is now on the ground, and it is expected that the works will be completed before Oct. 1. This will be a gravity system, with 1 mile of 10-in. and 1¼ miles of 8-in. mains extending from the reservoir to the village. There will be 17 hydrants, at a rental of $50 each per year. Estimated cost, $25,000. NICHOLAS FESSENDEN is Designing, and ED. L. HOUGHTON, Constructing Engineer.

Sanford, Me.—One-half mile of 4-in. pipe will be laid this season.

Sullivan, Me.—Address C. P. SIMPSON.

Milford, N. H.—WM. M. KNOWLTON has sent us the following:

The Milford Water-Works Co. failed to fulfill their contract to complete works by Dec. 1, 1888. The company has been reorganized and a new contract made with town, works to be finished by October 1. There will be 40 hydrants, with a rental of $50 each per year, and about 6 miles of 10 to 6-in. pipe. A 1,000,000-gall. pump will raise water to a 250,000-gall. stand-pipe, the latter to be at an elevation of 170 ft. above the public square. The town has the right to purchase the works within one year, at cost, with interest and bonus of 5 per cent. added; or to purchase them any time within 20 years at their actual value. Work was begun last week.

Vergennes, Vt.—The mains will be extended about ¼ of a mile, and 1 hydrant added.

Canton, Mass.—About 8 hydrants will be set this summer, 3 valves, and 8 meters: 1,400 ft. of 8-in., 2,000 ft. of 6, and 2,000 ft. of 4-in. pipe will be laid.

Chicopee Falls, Mass.—HENRY J. BOYD, Secretary, informs us that this year 2,000 ft. of 8-in. mains will be laid, and 460 ft. of 4-in. About one-half the 8-in. pipe is to replace 4-in. Five hydrants will be added.

Fairhaven, Mass.—A new charter has been granted the company, permitting them to supply both Fairhaven and Mattapoiset. The authorized capital stock is now $125,000. Water will be taken from Mattapoiset river. O. G. STANLEY is Engineer.

Peabody, Mass.—JAS. RODIE, Clerk, informs us that 1,500 ft. of 6-in. pipe will be laid this season.

Waltham, Mass.—About 3,300 ft. of 2 to 6-in. cement pipe is being replaced by from 4 to 12-in. cast-iron pipe.

North Brookfield, Mass.—Investigations are being made by authority of the town, with the idea of building works.

Windsor Locks, Conn.—A. L. FENNESSEY, Treasurer, of Springfield, Mass., sends the following information:

The Windsor Locks Water Co. began the construction of works June 1, and will finish them Oct. 1. The general contract has been let to S. P. Townsend & Son, Hartford, Conn. H. R. Worthington & Co., New York, have the contract for pumping machinery; the Warren Foundry & Machine Co., New York, for pipe and specials; R. F. Hawkins, Springfield, Mass., for stand-pipe. Dunham & Paine, Cleveland, O., are the engineers. The supply will be pumped from English brook to a stand-pipe 20 ft. in diameter and 100 ft. high. There will be about 7 miles of cast-iron pipe, and 30 hydrants. The works are estimated to cost $49,000. The franchise is exclusive. E. D. COOGAN is President, and J. W. JOHNSON, Secretary; both of Windsor Locks. Population, 3,000.

Canajoharie, N. Y.—There will be added this year 250 ft. of 6-in. pipe.

Castile, N. Y.—We are informed by J. H. VAN ARSDALE, Village President, that it has been proposed to extend the mains 2 miles, to supply Silver Springs with water.

Cuba, N. Y.—We are indebted to GEO. T. KEITH for the following:

The supply will be from springs by gravity to a distributing reservoir. The latter will have a capacity of 500,000 galls., at an elevation of 185 ft. above the main part of the town. There will be about 8 miles of 8 to 4-in. pipe, and 38 hydrants. The works are being built under the direction of the Water Commissioners, without a constructing engineer. The contractors are King & Keith, of Olean, N. Y., who expect to finish the works by August 1. Estimated cost, $29,000. Population, 1,500.

Granville, N. Y.—The mains will be extended about 1,200 ft.

Honeoye Falls, N. Y.—The mains will be extended this summer on several new streets.

Moravia, N. Y.—F. C. REYNOLDS, Superintendent, informs us that about 1,500 ft. of new mains will be laid this year, and that the company expect to build a large storage reservoir.

Le Roy, N. Y.—S. DAILEY GILBERT, Clerk, writes that new works are now under consideration to furnish water for domestic use. If built, a gravity system will be put in.

Walton, N. Y.—J. W. ST. JOHN, Superintendent, writes that about 1,500 of 4-in. mains will be laid in June.

Olean, N. Y.—JNO. Z. DEFEVRE, Superintendent, writes us that they expect to put in 3,000 ft. of mains, and necessary hydrants, this summer.

Jermyn, Pa.—The mains are being extended by 1,700 ft. of 4-in. cast-iron pipe.

Rochester, N. Y.—J. NELSON TUBBS, Chief Engineer, nforms us that next year the construction will be begun of an additional conduit from Hemlock and Canadice lakes. It will have a daily capacity of 15,000,000 galls., and is estimated to cost $1,500,000.

Rome, N. Y.—The extensions this season will be: 6,000 ft. of 6-in. and 1,000 ft. of 8-in. mains; 7 hydrants and 7 valves.

Warsaw, N. Y.—There will be laid this year 2,400 ft. of 12-in., 1,600 ft of 10-in., and 800 ft. of 8-in. pipe. There will be placed 6 hydrants, 4 valves, and 2 meters.

Catonsville, Md.—In addition to the placing of 12 hydrants, 20 valves and 2 meters, this summer, there will be laid 3,000 ft. of 8-in., 3,400 ft. of 6-in. and 1,600 ft. of 4-in. mains.

Covington, Va.—E. M. NETTLETON, President, has sent the following:

The Covington Water-Works Co. began their works in June and will finish them by August 1. The supply is from Spring branch by gravity, there being a 150,000-gall. reservoir. There will be 3 miles of cast-iron pipe and 11 hydrants. The contractors are Barry & Smith, Richmond, Va. Population, 600. Estimated cost, $8,000.

De Land, Fla.—The following is from SILAS B. WRIGHT, City Clerk:

Owing to the yellow fever in the State, the works were not built last year, as had been intended. Recently the City Council authorized the Fire Department Committee to employ a competent engineer to make plans and specifications for water-works.

Tampa, Fla.—A. E. BOARDMAN, Treasurer, has sent the following:

By December 1 the Company will add 26 hydrants and 3 miles of 8 to 4-in. pipe. A large spring has been purchased, and 1,000 ft. of 10-in. pipe will be laid to connect it with the present works. A boiler and pump will be placed at the spring at once. The works were accepted April 15, last.

Anniston, Ala.—JNO. H. TURNER, Mobile, Ala., informs us that construction will be begun at once on the new works at Anniston. Holly pumps and boilers will be used. H. MERIGOLD has the contract for pipe-laying. The works will cost $300,000.

Cleveland, O.—JNO. WHITELAW, Superintendent, writes that a new tunnel is now being built to the inlet crib in Lake Erie. It will be 7 ft. in diameter and 9,000 ft. long.

Columbus, O.—We are indebted to A. H. MCALPINE, Superintendent, for the following:

The contract for an open well, 31 ft. in diameter and 53 ft. deep, has been let to Free & Meredith, Pittsburg, Pa., for $16,220.

A new pumping station will be built at Alum creek with two 7,500,000-gall., triple expansion Holly-Gaskill pumping engines. The contract for foundation of engines and building will be let about July 1.

There will be laid this year 8,150 ft. of 24-in., 1,850 ft. of 20-in., 12,400 ft. of 16-in., 2,559 ft. of 12-in., 1,200 ft. of 8-in., 81,000 ft. of 6-in., and 3,000 ft. of 4-in. pipe, making a total of 110,259 ft., or about 21 miles.

Lima, O.—D. E. FRITZ, Superintendent, informs us that contracts have been let for pipe and pipe-laying on an extension of 1½ miles.

Urbana, O.—F. W. AMBROSE, Superintendent, reports the following extensions: a new 2,000,000-gall. Holly-Gaskill pump, 4½ miles 6 to 12-in. mains, and 32 hydrants.

Rockport, Ind.—A. H. KENNEDY, Superintendent of the Rockport Water Co., writes that they wish to change an 8 per cent. loan to one with a lower rate of interest.

Negaunee, Mich.—The extensions now in progress are the laying of 3,100 ft. of 4-in. mains, and setting 2 hydrants.

Portland, Mich.—W. F. SELLECK, Village Trustee writes that water-works have been proposed for the near future. Good water power is available. A small fire protection system is now in use.

Riverside, Ill.—JAS. D. REYNOLDS, Chairman of the Water-Works Committee, informs us that a contract for an artesian well, 5 ins. in diameter and about 2,000 ft. deep, was let May 1. This is in addition to the present supply, which is pumped from an artesian well to a tank.

La Crosse, Wis.—A mile of 6-in. pipe will be laid this year, and 6 hydrants set.

Tacoma, Wash. Ty.—The Tacoma Light & Water Co. inform us that they will lay this season 3 miles of 12-in., 5 miles of 6-in., and 7 miles of 4-in. pipe. They will also put in 4 miles of 30-in. conduit, and enlarge their flume. Probably 20 hydrants will be placed, and 12 or 15 meters.

Colton, Cal.—FRANK F. OSTER, Secretary of the Colton City Water Co., gives the following:

Jan. 1, 1889, the works were bought from the Colton Terrace Land & Water Co. The supply was from 5 artesian wells, yielding 15 miners' inches. The new company has purchased an additional 54 inches of water, and are relaying the pipe. The company does the trenching and covering, and J. D. Hooker & Co., of Los Angeles, the pipe-laying. There will be about 5 miles of pipe, no hydrants or meters, and 175 taps. The new works will be in operation June 15. T. M. TOPP is constructing engineer.

Stratford, Ont.—D. B. BURRITT, Secretary, writes that a new pumping main, at least 10 ins. in diameter, is contemplated. The present main will be retained.

Opinions and Notices of The Manual of American Water-Works.

I would not be without it for ten times the cost — G. H. COLEMAN, Superintendent Portsmouth & Suffolk (Va.) Water Co.

It is very well gotten up, complete, and a great aid to water-works.—JNO. B. HEIM, Ex-Superintendent Madison (Wis.) Water-Works.

Only those who work in the statistical field, and experience the difficulties of obtaining information from water-works for publication, can fully appreciate the value and completeness of the "Manual of American Water-works." Upon examination of it as to its correctness, we find far less mistakes than would naturally appear in compiling such a work, and on the whole is as reliable as any such work can be made.

Every water department should prize it, and keep it for reference. JOHN C. KELLEY,
President National Meter Co., New York City.

An invaluable volume of reference and instruction, conveniently arranged and handsomely printed.—Saginaw (Mich.) *Courier*.

This is an entirely new idea. These records should be useful to water-works men, to capitalists, and for general reference.—Montreal *Witness*.

The "Manual of American Water-Works" is the only complete description of the water-works of the United States and Canada ever published. It is consequently a most valuable volume.—Columbus (O.) *Despatch*.

It bears evidences of great care, and, so far as we are able to judge from the chapter devoted to California, it is full and accurate. The Manual covers a new field, and ought to be of great service to engineers and those interested in the important work of supplying pure water to cities.—San Francisco *Chronicle*.

This Manual is to be to water-works men what Poor's Manual is to railroad men.—San Francisco *Call*.